ATLC-107-932-100

CE0461

TECHNICAL MANUAL FOR

INTERVIEW® COMSTATE™ I

ATLANTIC RESEARCH CORPORATION
TELEPRODUCTS DIVISION
7401 Boston Boulevard, Springfield, Virginia 22153

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FOR TECHNICAL MANUAL FOR INTERVIEW COMSTATE I

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ADDENDUM

TO

TECHNICAL MANUAL for INTERVIEW COMSTATE I
ATLC-107-932-100, Issue 4, September 1985

This addendum was occasioned by the release of Software Versions 12.04A and 12.04B. Units with the newer software have keys that do not auto-repeat. The new software facilitates touch-typing in Terminal Mode by enabling "two-key rollover." The rollover function yields the combination "AB" (for example) when the typist presses the "B" key before releasing "A."

Other corrections involve memory locations in RAM and the warranty period for out-of-country shipments.

Revised Pages	ADD-932-04 Change (October 1985)
3, 4	Replace old page 3 with new 3.
F1, F2	Replace old page F1 with new F1.
H13, H14	Replace old page H13 with new H13.

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2 THE KEYBOARD

The COMSTATE I's alphanumeric keyboard, shown in Figure 2-1, is an ASCII keyboard with most of the characters in the standard ASCII font. Table 2-1 is a detailed description of the key functions in the COMSTATE I's various operating modes. (Note in Table 2-1, under "Alphanumeric keys," that there are several characters that the COMSTATE I can generate that are not shown on the face of the keyboard.)

2.1 KEY FUNCTIONS

At the upper right of the keyboard are two large keys, RUN and PROGRAM. Use these two keys to select the operating mode of the COMSTATE I. The RUN key starts the real-time data display, restarts the program, and resets the CRT buffer. The PROGRAM key puts the unit in Program mode and displays the Menu Selections directory; it is used with other keys to obtain the various program menus.

The cursor is controlled with the dark blue ENTER key and the four dark blue arrows arrayed at the right of the keyboard.

FLAG FOX, DON'T CARE, BIT MASK MSG, and ≠ are special data entry keys which will be explained as they are needed.

FREEZE, ROLL, XEQ, PRINT, and CLEAR are special-function keys that will be explained later in this manual. The HEX key is discussed in Section 2.3.

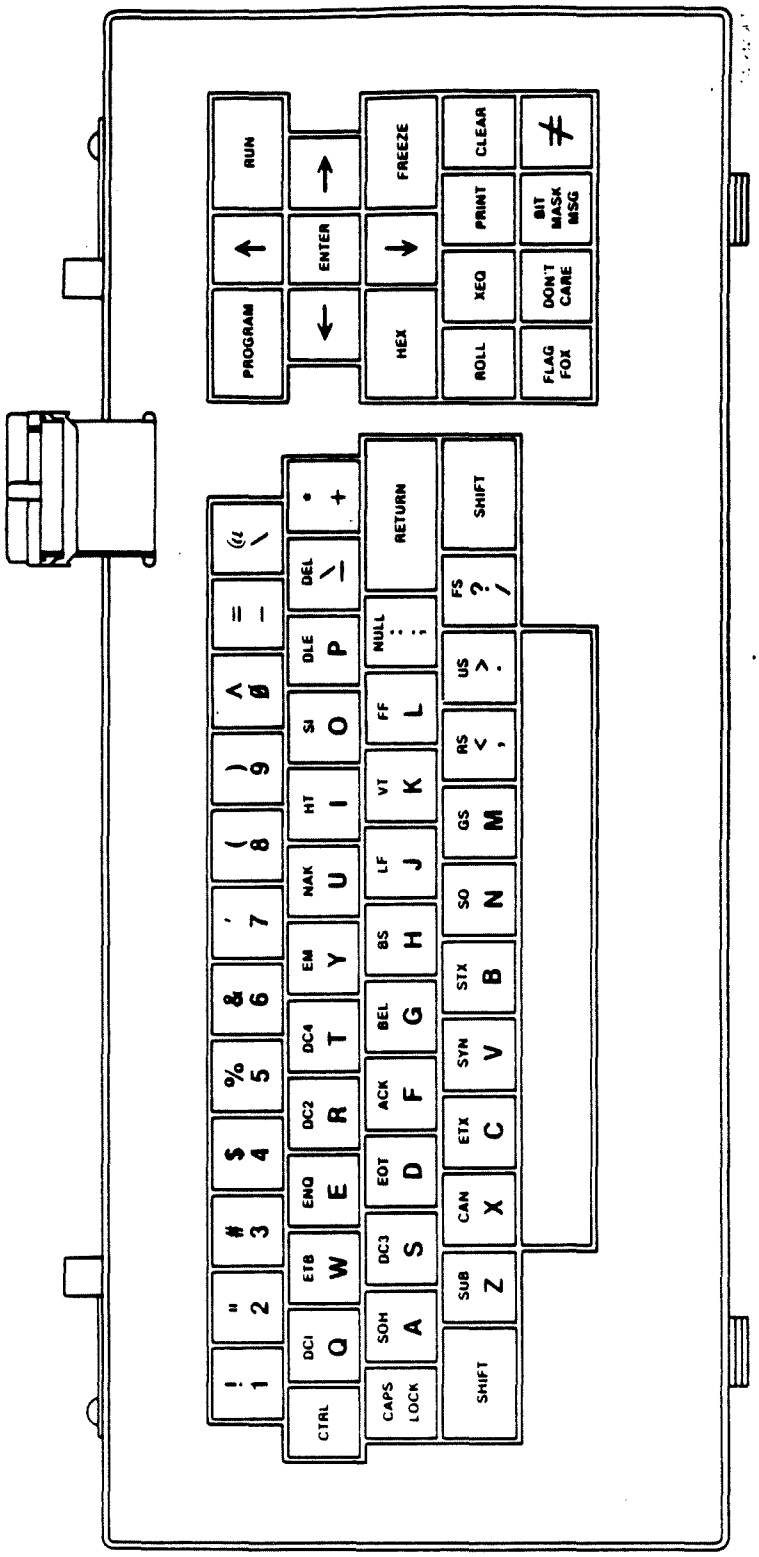

Figure 2-1 The COMSTATE I keyboard.

APPENDIX F
COMMUNICATIONS WITH THE ARC TELEPRODUCTS FACTORY

F.1 RETURNING A COMSTATE I OR SUBASSEMBLY FOR REPAIR

F.1.1 Authorization

(1) The first step is always to call the ARC Teleproducts REPAIR CLERK in Springfield, Virginia: 703-644-9020.

(2) The Repair Clerk will give you a RETURN AUTHORIZATION NUMBER. This number should be posted on the outside of the package of all equipment returned for repair, and cited in all documentation, written correspondence, or telephone conversations concerning the specific repair.

(3) Turnaround time for repairs is usually two weeks in addition to transportation time. The Repair Clerk can arrange to furnish a rental unit if it is not practical for you to be without the COMSTATE I for that length of time. We can either include the rental fee on the repair bill or bill the rental fee separately.

F.1.2 Shipping

(1) Always include with the shipment a detailed description of the problem to be corrected. Put the assigned RETURN AUTHORIZATION NUMBER on this document.

(2) If the item is out of warranty, you should either --

(a) authorize the amount of the repair in dollars;

(b) request an estimate of the amount of the repair.

(3) Select suitable packing materials for electronic equipment containing a cathode ray tube, and pack the COMSTATE I with care. If possible, the carton and "clamshell" packing material in which you received the equipment should be used for returning it for repairs.

(4) Write the RETURN AUTHORIZATION NUMBER on the outside of the shipment.

(5) Address the shipment to

REPAIR DEPARTMENT
Atlantic Research Corporation
Teleproducts Division
7401 Boston Boulevard
Springfield, Virginia 22153
U.S.A.

(6) Ship PREPAID. No collect shipments will be accepted unless previously authorized by the Repair Clerk.

(7) Most repairs will be completed within two weeks, not including transportation time.

F.2 ORDERING REPLACEMENT PARTS OR ASSEMBLIES

To obtain price quotations or to order spare or replacement parts, contact the REPAIR CLERK by telephone, 703-644-9020.

The Repair Clerk will need to know the model designation of the unit, its serial number and software version, and what options are already installed in it.

F.3 PC BOARD OR SUBASSEMBLY EXCHANGES

Contact the REPAIR CLERK to arrange to exchange PC Boards or Subassemblies that need repairs. The Repair Clerk can arrange to send you the replacement part immediately. You will then be responsible for the list price value of the part until ARC has actually received the returned part.

F.4 FOR ANALYSIS OF PROBLEMS

For assistance using ARC equipment in technical applications, call CUSTOMER SUPPORT, 703-644-9190.

For technical assistance with troubleshooting or repairing ARC equipment, call REPAIR DEPARTMENT at 703-644-9020.

F.5 WARRANTIES

There is a standard one-year warranty on this ARC Teleproducts equipment. This warranty is for parts, repair, and labor.

Extended Service Agreements are available on some equipment. Please contact the Repair Clerk, at 703-644-9020, for more information.

The RAM error code can be interpreted as follows. There are 16 RAM chips on the main PC board, at locations UI9 through UI16 and UJ9 through UJ16. (See Figure H-7.) If the address (xxxx in the power-up code) is in the hexadecimal range 8000 through BFFF, the error has occurred in a chip in the UI row; if the address is in the range C000 through FFFF the error has occurred in a chip in the UJ row.

To find the specific chip where the error occurred, look at the read (yy) and write (zz) values in the error code. Notice whether the discrepancy between the read and write values is in the high-order or the low-order digit; then, on Figure H-8, refer to only the high- or the low-order section of the applicable row.

In Figure H-8, a binary value is assigned to each RAM chip. Find the difference between the read and write values of the errored hex digit and compare it with the binary values in the correct row and section in Figure H-8. The errored chip will have the binary value equal to the difference between the read and the write values in the displayed error code.

For example, if the displayed error code is 0 (00, 8000, 00, 04), the error will be in the UI row of RAM chips, since the first digit in the address is 8, and in one of RAM chips UI9 through UI16, since the discrepancy between write and read values is in the low-order digit. Since the difference between the low-order write and read digit is 4 (= 0100), the faulty chip is at location UI14.

Another example: If the displayed error code is 0 (01, C000, 00, 90), the error will be in the high-order section of the UJ row. Actually, there will be two faulty chips, UJ16 and UJ9, because adding binary 1000 and 0001 is the only way to get a binary 1001 (= 9, hex) from the four possible binary numbers in the high-order section of the row.

NOTE: Having three or more ICs in error is highly unlikely. If the situation occurs, contact Atlantic Research Corporation for further instruction.

H.10 ERROR CODES IN RUN MODE

There are a number of error messages that indicate only that you have programmed a unit to do something it doesn't know how to do. Atlantic Research Corporation would appreciate it if you would let us know how all the program menus were set up when you received any of the following messages:

CMP ERR (01)
CMP ERR (02)
OVRFLW (10)
OVRFLW (11)
OVRFLW (12)

If you should receive the following error message,

XMIT OVERFLOW (20)

please record how the Interactive Test menu (Program 7) was set up and contact Atlantic Research Corporation.

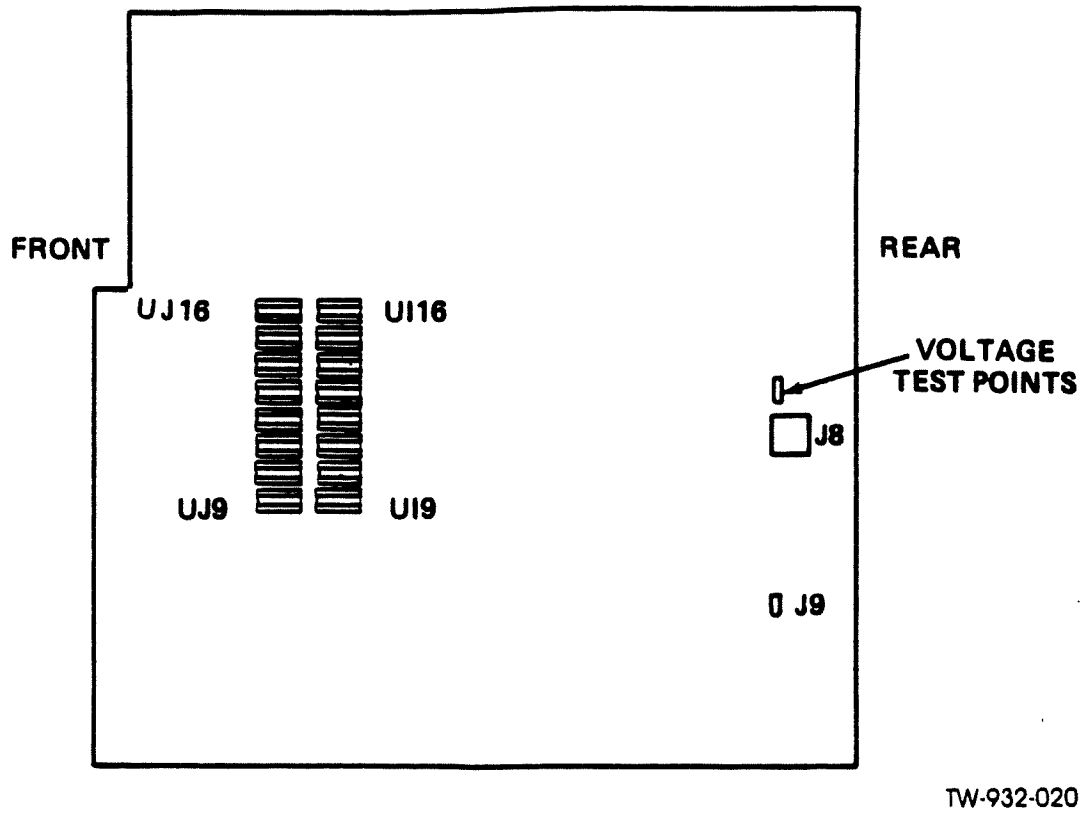

Figure H-7 RAM location on Main PC Board.

	LOW-ORDER HEX DIGIT				HIGH-ORDER HEX DIGIT			
8000	UI16	UI15	UI14	UI13	UI12	UI11	UI10	UI9
BFFF	0001	0010	0100	1000	0001	0010	0100	1000
C000	UJ16	UJ15	UJ14	UJ13	UJ12	UJ11	UJ10	UJ9
FFFF	0001	0010	0100	1000	0001	0010	0100	1000

TW-932-076

Figure H-8 Interpreting RAM error codes.

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NOTICE

Issue 4 of this Technical Manual was occasioned by the release of Software Version 12.04. Units with this software have the new combined frame and packet X.25 trace display; and they support Option 70, the internal 212-type modem. Atlantic Research Corporation reserves the right to improve this manual or the equipment that it describes without prior notice. Further software releases will not necessarily affect the material covered in the manual.

The menu configurations shown in this manual are intended only to demonstrate various techniques for programming the COMSTATE I. They are not necessarily appropriate for your real-world data environment.

Any duplication of this material in any form without prior written authorization of Atlantic Research Corporation is strictly prohibited.

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APPENDIX I. SELECTABLE DATA SPEEDS

PART I
GENERAL DESCRIPTION
AND
POWER-UP

Figure 1-1 The COMSTATE I.

1
OVERVIEW OF THE COMSTATE I

The COMSTATE I (Figure 1-1) tests V.35, X.21, or RS-232/V.24 data circuits interactively in a variety of protocols, and monitors at speeds up to 64 kilobits per second. The COMSTATE I has a 64 kilobyte (two bytes per character) RAM data buffer and optional nonvolatile memory for storage of data, test, and setups. The unit's eight programmable triggers take actions when specific user-definable conditions are met.

The COMSTATE I employs powerful "state" test logic to emulate a terminal (DTE) or modem (DCE). In an interactive test, the COMSTATE I operates in any one of up to 32 possible user-defined test states. These 32 test states, combined with the eight simultaneously active triggers, give you exceptional test power and versatility.

Other special features of the COMSTATE I include:

- Automonitor. The user can monitor data in any format, code, parity, or speed, simply by powering on the COMSTATE I and pressing PROGRAM, RUN. The unit configures itself automatically.
- Reanalysis of data. The entire 64 kb data buffer can be run repeatedly against one diagnostic test after another.
- A Statistics screen with readings for four labeled counters and one timer.
- Bit Error Rate Testing.
- Fully interactive asynchronous Terminal mode.

- Special X.21 menus and features.
- X.25-SDLC Monitor Trace Expansion display.
- Remote Transfer. Tests, setups, and data can be downloaded (directly or via modems) from another COMSTATE I or from a recording device such as the INTERVIEW 4600 or COMSTATE II. Tests, setups, and the entire data buffer can be transferred to another COMSTATE I or uploaded to an INTERVIEW recording device and stored on a tape cartridge.
- Printer Output. Program menus or the entire data buffer may be printed on most asynchronous serial ASCII printers.
- Unattended Remote Control. Functions that can be commanded by an operator at a COMSTATE I keyboard can also be controlled remotely (via modems) from a "dumb" or an ANSI terminal or from another COMSTATE I in Terminal mode. This includes remote-transfer features. An operator at a remote terminal can program a test, run it, and then access the COMSTATE I's data buffer, statistics screen, and BERT screen. He also receives real-time feedback (prompts and alarms) while the test is running. In addition, the COMSTATE I will react to an alarm trigger by dialing a call to a remote terminal.

This manual contains the information you will need to operate the COMSTATE I. The manual first covers the hardware and power-up of the COMSTATE I (in Part I); then, Parts II and III discuss setting the basic parameters and control of the data buffer useful for basic monitoring. Part IV introduces the triggers, and Part V discusses interactive testing and the state concept in detail. Part VI contains sections on the various COMSTATE I utilities: expansion memory, printer control, and remote transfer. The Appendixes contain useful information on different aspects of the COMSTATE I's operation and maintenance.

Most of the figures in this manual are printed directly from the COMSTATE I's video output. Because positive images of the screen are difficult to read on the printed page, we have used negative reproductions throughout.

2
THE KEYBOARD

The COMSTATE I's alphanumeric keyboard, shown in Figure 2-1, is an ASCII keyboard with most of the characters in the standard ASCII font. All the keys on the COMSTATE I repeat when held down. Table 2-1 is a detailed description of the key functions in the COMSTATE I's various operating modes. (Note in Table 2-1, under "Alphanumeric keys," that there are several characters that the COMSTATE I can generate that are not shown on the face of the keyboard.)

2.1 KEY FUNCTIONS

At the upper right of the keyboard are two large keys, RUN and PROGRAM. Use these two keys to select the operating mode of the COMSTATE I. The RUN key starts the real-time data display, restarts the program, and resets the CRT buffer. The PROGRAM key puts the unit in Program mode and displays the Menu Selections directory; it is used with other keys to obtain the various program menus.

The cursor is controlled with the dark blue ENTER key and the four dark blue arrows arrayed at the right of the keyboard.

FLAG FOX, DON'T CARE, BIT MASK MSG, and ≠ are special data entry keys which will be explained as they are needed.

FREEZE, ROLL, XEQ, PRINT, and CLEAR are special-function keys that will be explained later in this manual. The HEX key is discussed in Section 2.3.

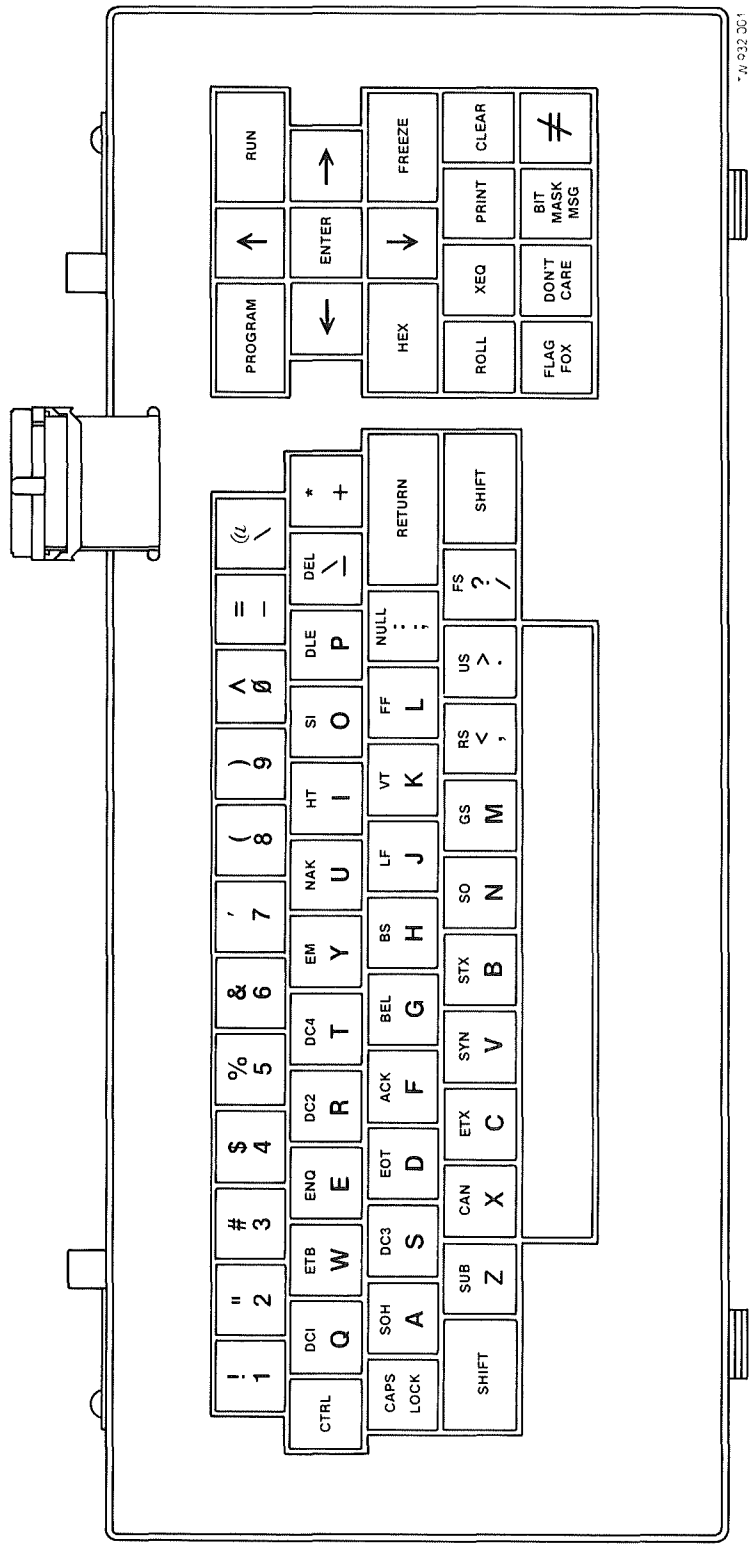


Figure 2-1 The COMSTATE I keyboard.

The SHIFT key must be held down while a character key is pressed for capitals or for the special characters to be entered. The CAPS LOCK key may also be used to enter capital letters or numerics. To enter control characters, hold down the CONTROL key while you press the key with the appropriate control character mnemonic.

Appendix B defines the control character mnemonics displayed by the COMSTATE I.

2.2 CODE CONVERSIONS

When a code other than ASCII has been selected on the Protocol Setup menu, the COMSTATE I automatically translates each ASCII character or control character mnemonic into the correct bit pattern for that code. Appendix A contains translation tables for the COMSTATE I's standard codes.

2.3 HEXADECIMAL ENTRIES

The HEX key displays data in hexadecimal, or lets you enter hexadecimal characters. The key locks on, as shown by the red HEX indicator on the front panel. When the HEX key is pressed in Program mode, only hexadecimal characters (0 through F) are legal. Each two consecutive alphanumeric keys are interpreted as a two-digit hexadecimal number, and displayed in one character space in the data-entry field.

HEX is an alternate action key; press it once to turn HEX on, and press it again to turn HEX off. The front panel indicator will go off and HEX will be disabled.

The COMSTATE I accepts the hexadecimal digits only in pairs. If you move the cursor from a character-entry position after entering an odd number of digits with the HEX key on, the last digit will be discarded. If you try to turn HEX off after entering only one digit in a character-entry position, the error tone will sound. You will not be allowed to turn HEX off until you have either entered a second digit or moved the cursor to another position.

The COMSTATE I does not compute parity on hexadecimal entries. If you have selected PARITY on the Protocol Setup menu, you must remember to adjust each hexadecimal entry for parity.

When viewing data in Run mode or from the Data Buffer, pressing HEX displays all the data in hexadecimal notation. Pressing HEX again returns the display to normal. CONTROL-HEX or SHIFT-HEX displays only the control characters in hexadecimal.

Finally, when the COMSTATE I is operating as an asynchronous terminal, the HEX key performs a slightly different function. When HEX is on, the COMSTATE I displays each individual keystroke in its hexadecimal equivalent.

TABLE 2-1
KEYBOARD KEY FUNCTIONS

Key	Functions		
	Program Mode	Real-Time Data Display	CRT Buffer Displays
	Dark Blue Keys		
ENTER	Moves cursor to current selection in next field (or first data-entry position of next field) in menu, whether to right or down.	May be used as a trigger or test condition.	Invalid
Cursor arrows			
UP	Moves cursor to current selection (or first data-entry position of first field).	Invalid	Moves cursor up 1 line in the buffer.
DOWN	Moves cursor to current selection (or first data-entry position of first field).	Invalid	Moves cursor down 1 line in the buffer.
RIGHT	Moves cursor one position to the right.	Invalid	Moves cursor 1 character to right (which may be first character in next line).
LEFT	Moves cursor 1 position to left.	Invalid	Moves cursor 1 character to left (which may be last character in preceding line).

(continued)

Table 2-1 (continued)

Key	Functions		
	Program Mode	Real-Time Data Display	CRT Buffer Displays
SHIFT-UP or CONTROL-UP (Two keys pressed at same time)	Deletes line of Interactive Test menu where cursor is positioned. In Library Utilities or Test Library menu, displays preceding page of the directory.	Invalid	Displays preceding page of the buffer.
SHIFT-DOWN or CONTROL-DOWN	Inserts blank line on Interactive Test menu where cursor is positioned. In Library Utilities or Test Library menu, displays next page of directory.	Invalid	Displays next page of the buffer.
SHIFT-RIGHT or CONTROL-RIGHT	Inserts a space at the cursor location in a data-entry field.	Invalid	Invalid
SHIFT-LEFT or CONTROL-LEFT	Deletes the character at the cursor location in a data-entry field.	Invalid	Invalid

(continued)

Table 2-1 (continued)

Key	Functions		
	Program Mode	Real-Time Data Display	CRT Buffer Displays
	Light Blue Keys		
PROGRAM	Displays the Menu Selections directory. Aborts remote transfer, printer output, or expansion memory function.	Places unit in Program Mode and displays the Menu Selections directory.	Places unit in Program Mode and displays the Menu Selections directory.
RUN	Puts unit in Run Mode and starts the program. Resets counter and timer, resets CRT buffer. If BERT is selected, starts BERT test.	Starts program, resets counter and timer, resets CRT buffer. In BERT mode, resets BERT counters and timers, but does not interrupt BERT transmission.	Places unit in Run Mode; starts program, resets counter and timer, resets CRT buffer.
DON'T CARE	Enters Don't Care (DC hex) character in a data-entry field.	In BERT mode, forces a bit error.	Invalid
FLAG FOX	Enters 7E (hex) flag byte for HDLC or SDLC framing. In Interactive Test ACTION fields, enters Fox message.	Invalid	Invalid

(continued)

Table 2-1 (continued)

Key	Functions		
	Program Mode	Real-Time Data Display	CRT Buffer Displays
BIT MASK MSG	Allows you to specify status of each bit of a character in a data-entry field. In Interactive Test ACTION fields, enters Message Buffer.	Invalid	Invalid
≠ (Not Equal)	Not Equal followed by any other character (or BIT MASK) specifies all characters not equal to that character.	Invalid	Invalid
CLEAR	Clears data-entry field (including binary fields) at the cursor location. Invalid in selection fields.	Clears data buffer and display, but not lines 1 and 2 on the CRT.	Invalid
SHIFT-CLEAR or CONTROL-CLEAR	Clears entire menu to default condition.	Invalid	Invalid
ROLL	Displays rotating selections in WAIT FOR and BCC fields (Interactive Test menu) and PARAMeter field (X.21 Protocol Control menu).	Invalid	Invalid
SHIFT-ROLL or CONTROL-ROLL	Displays rotating selections in reverse order.	Invalid	Invalid

(continued)

Table 2-1 (continued)

Key	Functions		
	Program Mode	Real-Time Data Display	CRT Buffer Displays
XEQ (Execute)	With Remote Transfer menu displayed, executes remote transfer functions. With Library Utilities or Test Library menu displayed, executes memory functions.	Invalid	Invalid
PRINT	Prints menu currently displayed.	Invalid	Prints current data display.
SHIFT-PRINT or CONTROL-PRINT	Invalid	Invalid	Prints entire 64-page buffer.
HEX (alternate-action key)			
ON	Only hexadecimal (0 through F) keys are legal. Every two consecutive keys are taken as one 2-digit hexadecimal number. If parity is selected, operator must adjust parity of each entry.	Displays all data in hexadecimal.	Displays all data in hexadecimal.
OFF	Hexadecimal entries cannot be made.	Displays all data as clear text.	Displays all data as clear text.
SHIFT-HEX or CONTROL-HEX	Invalid	Displays only control characters in hexadecimal.	Displays only control characters in hexadecimal.

(continued)

Table 2-1 (continued)

Key	Functions		
	Program Mode	Real-Time Data Display	CRT Buffer Displays
FREEZE (alternate-action key)			
ON	Invalid	Stops addition of data to CRT buffer. Stops program.	Not Applicable
OFF	Invalid	Not Applicable	Valid only in Freeze. Starts Program and resets data buffer. Restores trigger control of CRT.
Alphanumeric keys	Valid in data-entry fields. Not all keys are valid in all data-entry fields. NOTE: Not all characters are represented on face of keys (Figure 2-1). Additional characters displayed and transmitted by the COMSTATE 1 are the following: BREAK = CTRL \ ESC = CTRL + ~ = CTRL 5 { = CTRL 6 } = CTRL 7 [= CTRL 8] = CTRL 9 | = CTRL 0 ` = SHIFT _	Valid only in Terminal mode.	"B" displays Beginning of CRT buffer; "E" displays End of buffer. For X.25 Trace: For next frame on frozen data display, "F" gives frame expansion; "P" gives packet expansion. For frame where cursor has been manually positioned, SHIFT-F gives frame expansion; SHIFT-P gives packet expansion.

(continued)

Table 2-1 (continued)

Key	Functions		
	Program Mode	Real-Time Data Display	CRT Buffer Displays
Alphanumeric Keys (continued)			For X.25 Trace: (continued) On dual-line display, "T" selects TD data for SHIFT-F or SHIFT-P expansion; "R" selects RD data. "2" replaces frozen display with X.25 Trace of frame-level protocol. "3" replaces frozen display with X.25 Trace of packet-level protocol. "4" replaces frozen display with X.25 combined frame and packet trace. "1" returns to data display.
CAPS LOCK (alternate-action key)			
ON	Enters capital letters, but leaves other keys unshifted.	Not Applicable	Not Applicable
OFF	Entire keyboard unshifted.	Not Applicable	Not Applicable

3
THE FRONT PANEL

The COMSTATE I front panel is divided into three functional areas: INTERFACE ACCESS, COMSTATE STATUS, and UNASSIGNED INPUT (see Figure 3-1). The INTERFACE ACCESS area is itself divided into an RS-232 area and an X.21/V.35 area. This section discusses the function of each area on the front panel.

3.1 RS-232/V.24 INTERFACE ACCESS

The RS-232/V.24 25-pin connector is at the far right of the INTERFACE ACCESS area. When the COMSTATE I monitors or tests a RS-232/V.24 or X.21BIS data line, the line should be connected to the front panel via this connector.

Two columns of patch jacks, labeled with the appropriate RS-232 interface pin numbers, are to the left of the RS-232 connector. Using the single-wire patch cords provided with the COMSTATE I, you may patch any of these leads to the leads at the left of the breakout switches, or to the leads in the Unassigned Input area.

The ten DIP switches on the breakout box conduct signals straight through, or they open the circuits so that you can reroute them using the single-wire patch cords.

When the COMSTATE I is in Monitor mode, patching or switching the leads on the front panel affects only the received data, not actual data on the line. When the COMSTATE I is in a Test mode (TEST DCE or TEST DTE), however, any patching or switching on the front panel directly affects the data output to the terminal or modem. This control gives you test flexibility additional to the selections on the RS-232/V.24 Interface Control menu (see Section 26).

To the left of the breakout switches is another row of patch jacks for the ten switched leads. These jacks give you access to the signals actually received or transmitted by the COMSTATE I.

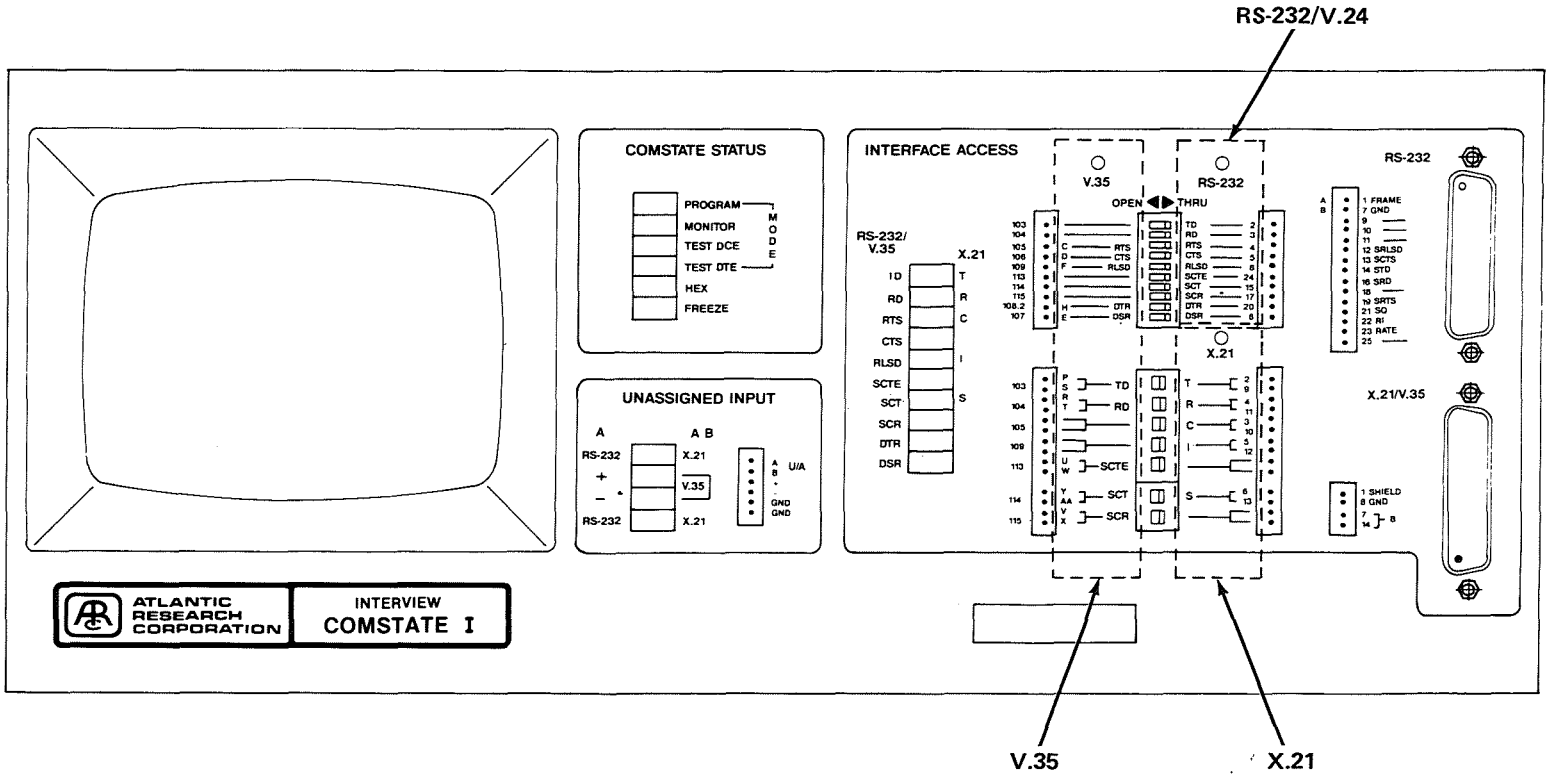


Figure 3-1 The COMSTATE I front panel.

TW-932-084

There is a red LED indicator for each of the ten leads. The indicators turn on for nominal voltages over +3 V. The indicators always show what the COMSTATE I sees, but, because of the breakout switches, not necessarily what is on the interface. With a COMSTATE I in Test DTE mode, for example, the indicator light may show the unit driving SCT on. If the switch on pin 15 is OPEN, however, the signal will not be seen on the interface.

When lit, the single LED marked RS-232 indicates that the RS-232/V.24 connector is active. Only one of the front panel's connectors is active at any given time.

3.2 X.21/V.35 INTERFACE ACCESS

The 25-pin "generic" X.21/V.35 connector is at the far right of the INTERFACE ACCESS area, below the RS-232 connector. Included in your COMSTATE I shipment were two adaptor cables each with one 25-pin female connector. One adaptor cable converts the X.21/V.35 generic connector to X.21. The other cable provides a V.35 interface. Whenever the COMSTATE I monitors or tests an X.21 or a V.35 data line, the line should be connected to the front panel via one of these adaptor cables and this connector.

Two columns of patch jacks are to the left of the X.21 connector. These jacks correspond to all of the X.21 leads and to some of the V.35 leads -- the balanced two-wire (data and clock) signals only. V.35 balanced leads are the following, with their pin designators in parentheses: TD (P, S), RD (R, T), SCTE (U, W), SCT (Y, AA), and SCR (V, X). The patch jacks for unbalanced V.35 leads are found on the upper part of the Interface Access area, where they correspond to the RS-232 leads of the same or similar name. Unbalanced V.35 control leads are the following: PROT GD (A), SG (B), RTS (C), CTS (D), RLSD (F), DTR (H), and DSR (E).

The two columns of patch jacks at the left of the X.21/V.35 connector are for balanced two-wire signals only. These include all X.21 leads and some V.35 leads (data and clock). Using the twisted-pair patch cord provided with the COMSTATE I, you may patch any of these pairs of leads to the leads at the left of the breakout switches, or to the leads in the Unassigned Input area.

To the left of the two columns of balanced-lead patch jacks is a set of breakout switches. The seven DIP switches conduct signals straight through, or they open the circuits so that you can reroute them using the twisted-pair patch cord.

NOTE: Always keep the colors of the twisted pair oriented in the same direction to maintain correct balance. For example, if you patch one pair of X.21 or V.35 leads with the yellow wire on top and the blue wire on the bottom, be sure to connect the other end with the yellow on top and the blue on the bottom.

When rerouting or opening any circuits involving the V.35 unbalanced control leads, use the patch jacks and breakout switches on the upper half of the Interface Access area, to the left of the RS-232 connector.

NOTE: Patching or switching the leads on the front panel can affect not only the received data but also the actual data on the line, even when the COMSTATE I is in MONITOR mode.

To the left of the breakout switches is another row of patch jacks for the seven balanced signals that are required either for X.21 or for V.35. Use these jacks to access those signals actually received or transmitted by the COMSTATE I.

There is a red LED indicator for each of the seven signals. These indicators turn on for relative voltages of A over B of over +0.3 V. The indicators always show what the COMSTATE I sees, but, because of the breakout switches, not necessarily what is on the interface. With the COMSTATE I in Test DTE mode, for example, the indicator light for the S lead may show the unit driving that lead; but if switch 6 is OPEN, the signal will not be seen on the interface.

When lit, the single LED marked X.21 indicates that the X.21/V.35 connector is being used in conjunction with the X.21 adaptor cable. The V.35 LED indicates that the V.35 adaptor cable is connected. Only one of the front panel connectors is active at any given time.

3.3 COMSTATE STATUS

At the upper left of the front panel is the area labeled COMSTATE STATUS. This area gives you information on the type and status of the operation being perfomed by the COMSTATE I. The first four lights indicate the mode, or type, of operation being performed: PROGRAM, MONITOR, TEST DCE, or TEST DTE. The other two lights, HEX and FREEZE, are activated whenever the HEX or FREEZE keys on the keyboard are latched ON.

The Run mode LEDs (MONITOR, TEST DCE, TEST DTE) remain lit even when the COMSTATE I is in Program mode. They remain lit because the signals indicated on the Interface Access LEDs are still being sent to the active connector.

3.4 UNASSIGNED INPUT

The UNASSIGNED INPUT area is at the bottom left of the Interface Panel. This area is designed to provide the following:

- An LED voltmeter for any lead (or pair of X.21/V.35 leads) patched in from the Interface Access area.
- A user-assignable input to the COMSTATE I.
- A glitch catcher.
- A fixed output for patching steady spaces or marks to the Interface Access area.
- Balanced or unbalanced grounds.

The top two pins on the pin column are the unassigned inputs A and B. These two pins work directly with the four LED indicators to their left. The LEDs light when the unassigned input exceeds the input thresholds. There are four input thresholds for signals patched to the A pin (B assumed to be signal ground): +3 V, +1 V, -1 V, and -3 V. When any threshold is exceeded, an LED indicator will light (with the upper positive threshold corresponding to the upper LED, the lower positive threshold corresponding to the second LED from the top, and so forth). The A-pin thresholds apply to RS-232 leads and V.35 unbalanced leads.

There are also four input thresholds for balanced signals patched to the AB pins, each threshold corresponding to an LED indicator. These thresholds are: +.3 V, +.1 V, -.1 V, and -.3 V.

The COMSTATE I's triggers can monitor the unassigned input, and actions can be initiated when the signal crosses the appropriate threshold (±3 V for RS-232/V.24 and unbalanced V.35 signals, or relative ±0.3 V for X.21 or balanced V.35 signals).

You can patch any single RS-232 or (unbalanced) V.35 lead or pair of X.21/V.35 balanced leads in the unassigned input. For unbalanced leads, use only the A lead for patching.

CAUTION: For unbalanced signals (including all RS-232 signals), patch only into pin A on the unassigned input; never use pin B.

Patching of X.21 or V.35 two-wire signals should be done only with the blue and yellow twisted-pair patch cords provided with the COMSTATE I.

CAUTION: To maintain polarity on balanced (X.21/V.35) signals, always patch A to A and B to B; use the color coding of the patch cord as an aid.

The unassigned input can also catch glitches on any interface lead. Whenever the voltage spikes higher than +3 V or lower than -3 V on an unbalanced lead (or A spikes ±0.3 V relative to B on a balanced lead) for at least one microsecond, the input latches until trigger logic (the UA field on trigger-condition menus) can check it.

Two 5 V output pins are below the two unassigned input pins. These pins may be used to patch steady spaces or marks out to the Interface Access leads. For A-lead patching, +5 V is a space, and -5 V is a mark. For balanced patching, orienting both ends of the patch the same (for instance, yellow on top) will output a space or ON signal; turning either end of the patch over will output a mark or OFF signal.

The two ground pins on the bottom of the pin column are provided for balanced or unbalanced use.

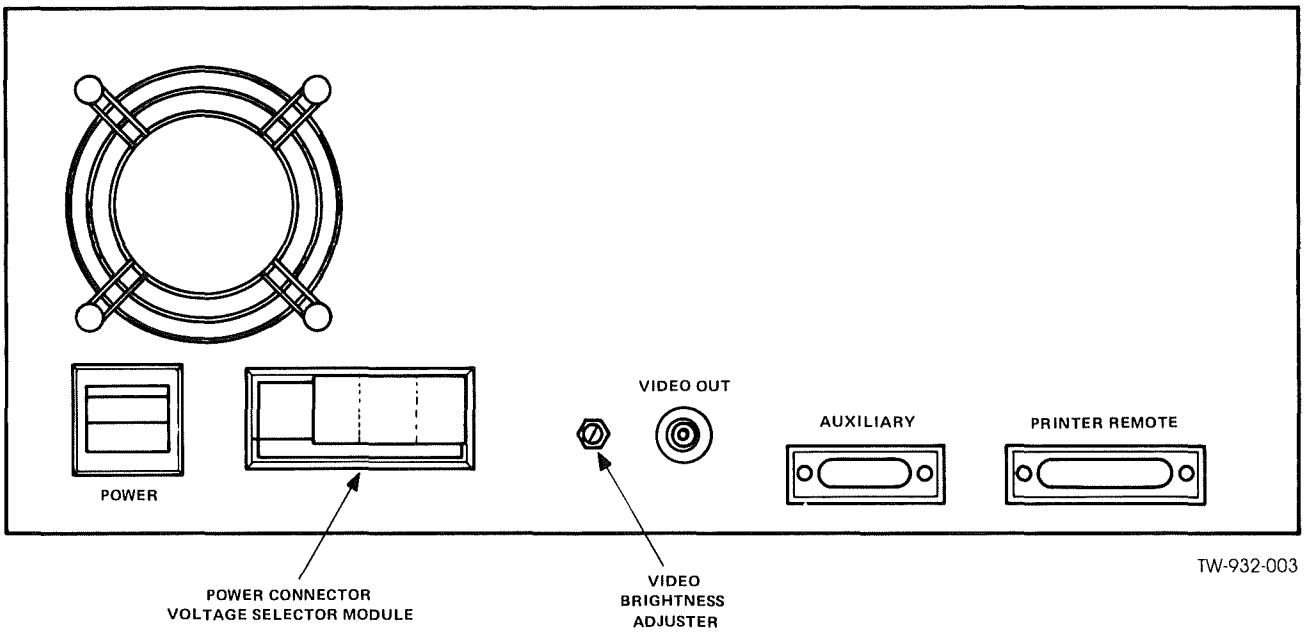


Figure 4-1 Rear panel of the COMSTATE I.

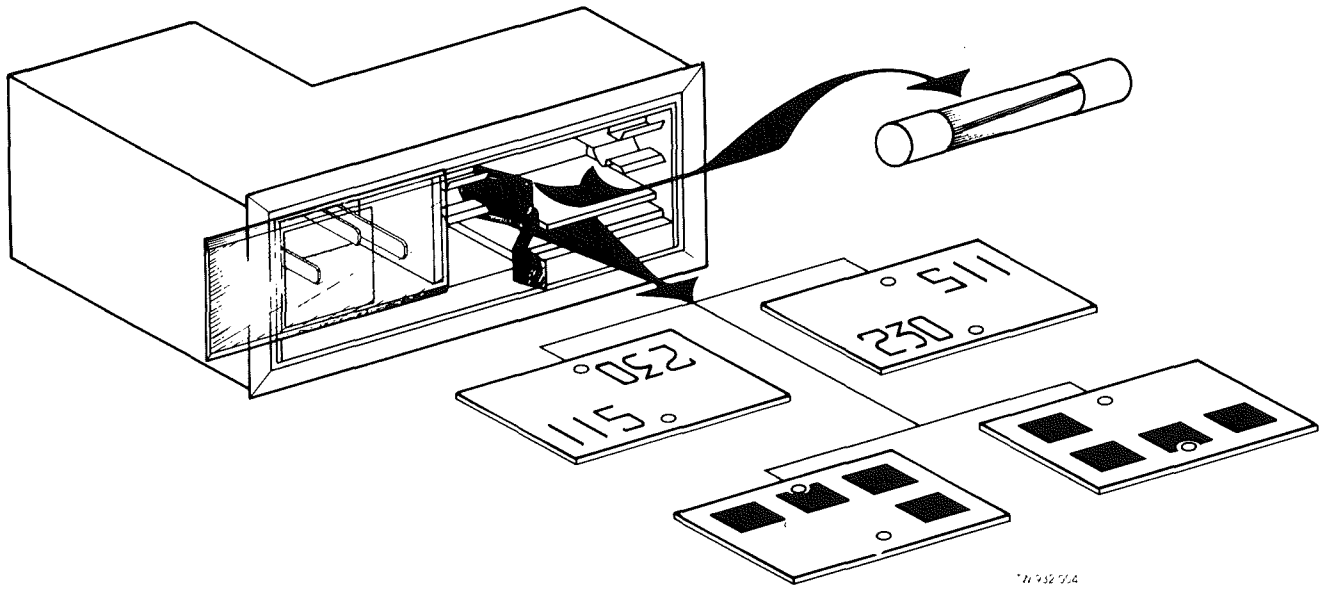


Figure 4-2 Power connector-voltage selector module (see Figure 4-1).

4
POWER-UP INFORMATION

4.1 VOLTAGE SELECTION

The COMSTATE I is designed to operate from 90 to 132 V ac, 50 or 60 Hz when the unit is set for 115 V; or from 180 to 264 V ac, 50 or 60 Hz when it is set for 230 V.

NOTE: The frequency must be selected separately (see Section 4.2).

The voltage selector is part of the power connector module on the rear panel of the COMSTATE I (see Figures 4-1 and 4-2). Slide the transparent window to the left. The line voltage selector card can be seen at the bottom of the window with the present voltage selection visible -- and right side up.

To change the line voltage selection, swing the fuse extractor handle (labeled FUSE PULL) out toward the left, and remove the fuse. The voltage selector card can then be removed and turned so the correct line voltage can be read in the window. When the voltage selector card has been seated correctly, rotate the fuse extractor handle to the right and in, and replace the fuse.

4.2 POWER FREQUENCY SELECTION

The COMSTATE I can be operated at either 50 or 60 Hz. It is shipped adjusted for 60-Hz operation. The frequency selection only affects the frame rate of the CRT; it has no effect on the tests or data being observed. If the frequency selected is not operating properly, or if the unit is operating near a transformer or magnetic source, the CRT display may deteriorate, but the program will not be distorted. If the CRT display fails to operate properly, see the instructions for setting the power frequency in Appendix H.

4.3 SETUP

Rotate the stand on the bottom of the unit forward until it locks; then set the unit on its stand.

Lift the two black latches on top of the unit and slowly let the keyboard down.

CAUTION: Be sure to hold the keyboard whenever you lift the latches. If you do not hold the keyboard, it may fall as soon as the latches are released, potentially damaging the unit.

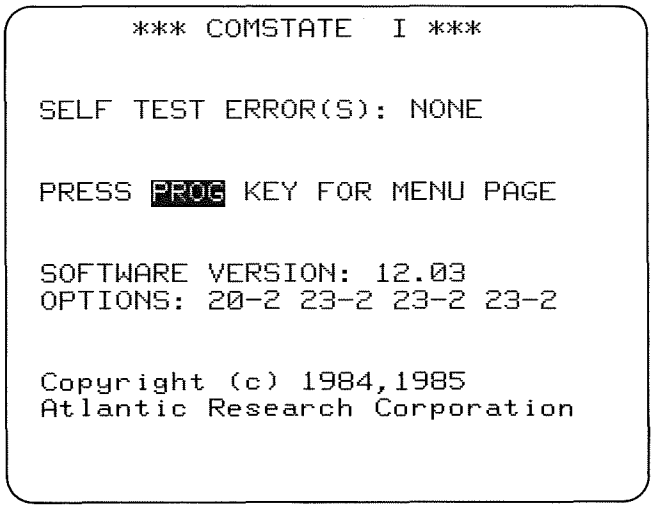


Figure 4-3 Power-up display.

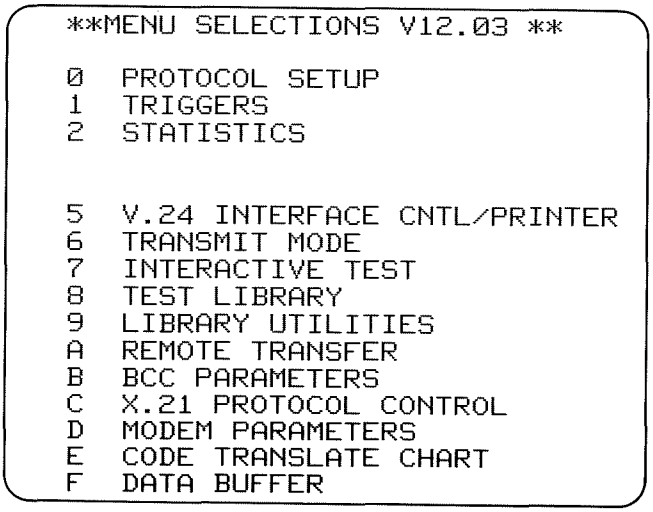


Figure 4-4 Menu Selections directory.

In the accessory pouch on top of the unit you will find the power cord, an RS-232/V.24 T-cable, X.21 and V.35 adaptor cables, and several single-wire and twisted-pair patch cords.

Slide the window on the power connector module (on the rear of the unit) to the right to expose the connector pins, and connect the power cord to the COMSTATE I. Connect the power cord to a three-wire grounded power outlet. The power cord connects the protective ground wire to the chassis.

WARNING: Be sure to connect the COMSTATE I only to a properly grounded power outlet.

CAUTION: When you power up the COMSTATE I, be sure the ventilator fan in the rear runs and neither the fan exhaust nor the intake holes in the side of the case are obstructed.

4.4 POWER-UP

CAUTION: Do not connect the unit to a live data interface until you have finished reading this section.

Turn on the COMSTATE I using the POWER rocker switch on the rear of the unit (see Figure 4-1). A long "beep" tone will confirm that the unit is operating. (Later, you will find that a long beep is also used as an error tone and as an alarm.) The heading of the Power-up display (Figure 4-3) confirms you are using the COMSTATE I.

After a short delay for the automatic power-up tests, the SELF TEST ERROR(S) line should display NONE. If an error code should be displayed, see Appendix H before you attempt to use the unit.

Also on the display are two other useful pieces of information. You will need the SOFTWARE VERSION if you contact Atlantic Research about your unit. The OPTIONS line tells you which of the options discussed in this manual have been installed in the unit.

For normal monitoring operation, connect the data line to the appropriate connector on the front panel of the COMSTATE I. Use the T-cables or adaptor cables supplied with the COMSTATE I or the patch equipment at the site. All the breakout switches in the center of the panel should be in THRU position so the COMSTATE I can monitor all the leads of the RS-232/V.24, X.21, or V.35 interface.

Press the PROGRAM key to display the Menu Selections directory. This lists all the Program mode menus available (Figure 4-4) in the unit, and also displays the software version. You can now monitor data simply by connecting to a live data interface and pressing RUN. Since AUTOMONitor is a default selection on the PROTOCOL SETUP menu (see Section 10), the COMSTATE I will analyze the interface, configure itself, and begin monitoring the data automatically. Or you can configure the unit yourself by making a few selections on the Protocol Setup menu as explained in Sections 5 through 9.

PART II
BASIC PARAMETERS

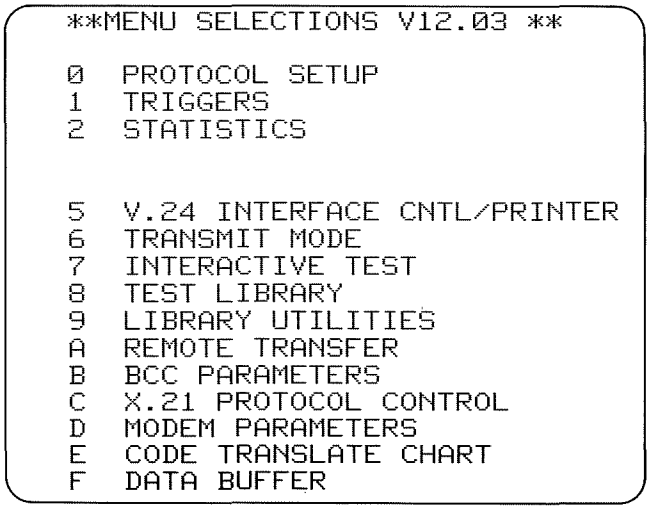


Figure 5-1 Pressing PROGRAM always displays the Menu Selections directory.

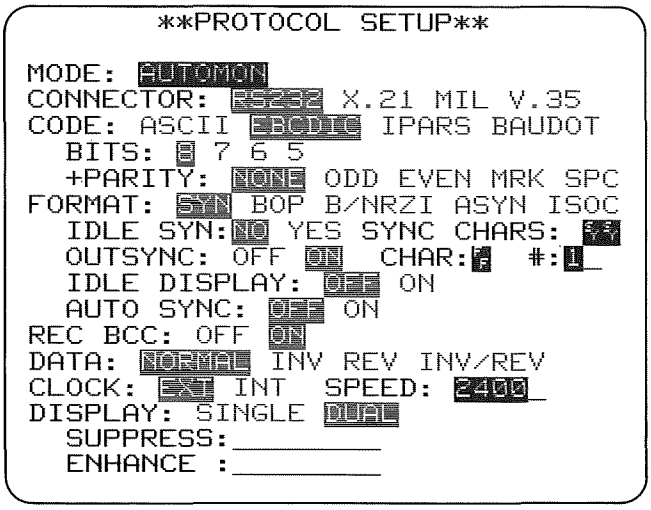


Figure 5-2 Protocol Setup menu.

5
HOW TO USE THE PROGRAM MENUS

5.1 SELECTING PROGRAM MENUS

The operator programs the COMSTATE I by filling out a series of menus. All the menus available in your unit are listed on the Menu Selections directory (shown in Figure 5-1) displayed when you first put the unit in Program mode.

To see a menu, find its identification number in the first column of the Menu Selections directory; then press the corresponding key. The menu you want appears immediately, ready for your programming selections.

The Menu Selections directory must be on the screen at the time you enter the menu identification number. To display the Menu Selections directory again, press the PROGRAM key.

5.2 USING THE CURSOR TO MAKE PROGRAM SELECTIONS

The COMSTATE I's various program menus offer three categories of programming fields: rotating windows, selection fields, and data-entry fields. In a rotating window, the selections appear one by one as you repeat the ROLL key. Each succeeding selection replaces the previous one until the cycle begins again. The MODE: field is the one rotating window on the Program 0 menu (Figure 5-2). Press ROLL and AUTOMON changes to MON. Repeat the keystroke and the selections change to TEST DCE, TEST DTE, REANALYZE, and then AUTOMON again. (SHIFT-ROLL reverses the rotation.)

Most of the fields on the Program 0 menu are selection fields. These offer a range of entries that are visible even when another entry is selected. The current selection is displayed in low-intensity reverse image, as in the CODE line of Figure 5-2.

Type data directly into a data-entry field. Entries in these fields are displayed in bright reverse image. In Figure 5-2, for instance, OUTSYNC: OFF ON is a selection field, and the box after CHAR: is a data-entry field. SUPPRESS and ENHANCE are also data-entry fields. When entries are made in these fields, they appear in bright reverse image.

Make entries in selection fields by positioning the blinking, bright, reverse-image cursor. To move the cursor from one field to the next without changing prior selections, press the ENTER key. The cursor will move directly to the default or prior selection in the next field or to the first position in the case of a data-entry field. To move the cursor within a field, use the

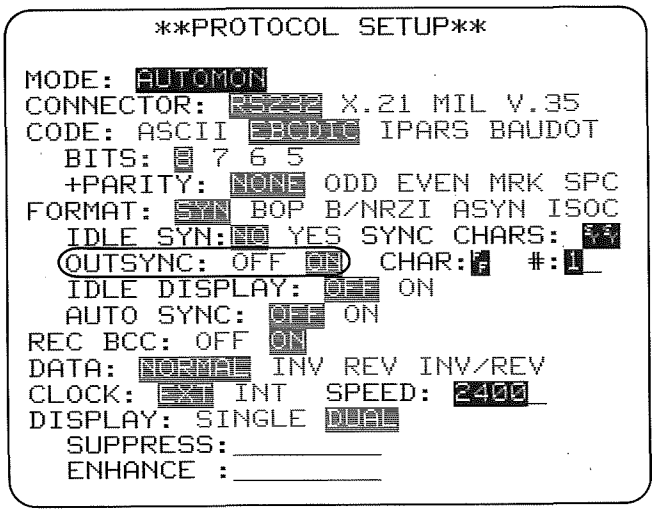


Figure 5-3 To move from OUTSYNC back to SYNC CHARS, press the UP arrow key and then the ENTER key.

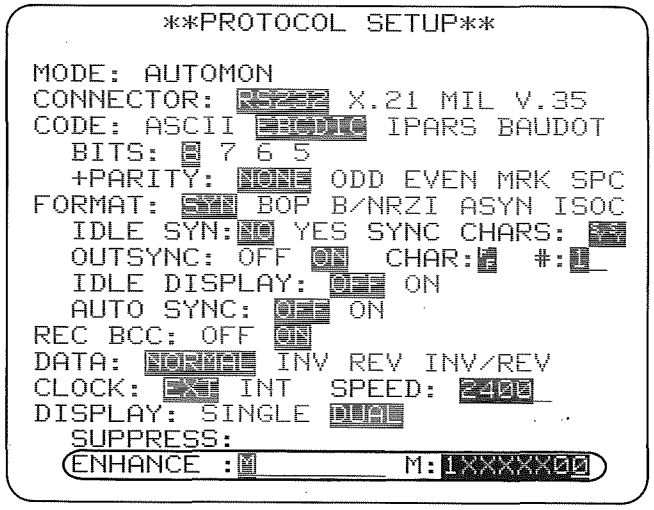


Figure 5-4 The Bit Mask is an example of a bit status field.

LEFT and RIGHT arrows. Once you have made your selection, use ENTER to leave the field. The UP or DOWN arrow will take you to the preceding or next line.

> NOTE: It is not a good habit to use the LEFT or RIGHT arrow to go to another field: it may change your selection in the present or in an intervening field. For example, suppose you have selected IDLE SYN: NO on the seventh line of Figure 5-2. If you use the RIGHT arrow to go to the SYNC CHARS field, it will change your IDLE SYN selection to YES. Use the ENTER key instead.

To return to a previous field, press the UP arrow to return to the preceding line. Then, if necessary, use the ENTER key to get to the field in which you are interested. For example, if the cursor is on OUTSYNC:ON (in Figure 5-3) and you want to return to the SYNC CHARS field, use the UP arrow to reach IDLE SYN, then the ENTER key to reach the SYNC CHARS field.

To correct a data entry, you may position the cursor on the error and write over it. (Backspacing with the LEFT arrow does not alter the data entry, but lets you then overtype the incorrect entry.) To insert a character, press the SHIFT or CONTROL key and the RIGHT arrow simultaneously. To delete a character, press the SHIFT or CONTROL key and the LEFT arrow simultaneously.

5.3 DECIMAL FIELDS

Certain fields, such as the SPEED field in Figure 5-3, are decimal-entry fields. Only numerals and the decimal point are legal in the decimal fields. If HEX is ON while you are making entries in these fields, the COMSTATE I will ignore it.

On the Protocol Setup menu, OUTSYNC # and SPEED are decimal fields. On the trigger menus, TIMEOUT: RESTART and COUNTER # are decimal fields. On the Printer Control menu (Program 5), TIMEOUT, CTS DELAY time, printer SPEED, and number of PADS are all decimal fields.

5.4 ASCII-CHARACTER FIELDS

There are several program menu fields in which only characters in the ASCII font will be accepted. Only alphanumeric keyboard characters or control character mnemonics should be used. If the HEX key is ON, it will be ignored, and all keys will be treated as though HEX were OFF.

There are several of these ASCII character fields in the COMSTATE I: the PROMPT-entry line on each Trigger menu; the legend fields for counters and timer on the Statistics menu (Program 2); the NEW LINE field on the Printer Control menu (Program 5); the NAME fields on the Test Library menu (Program 8), the Library Utilities menu (Program 9), and the Remote Transfer menu (Program A); and the three STRING fields on the Remote Parameters menu (Program D).

5.5 BIT STATUS FIELDS

There are a number of data-entry fields in which there are just three legal entries: 1 for ON; 0 for OFF: and DON'T CARE (X). These are the BIT MASK fields on the Protocol Setup and Trigger menus (see Figure 5-4), STATIC LEADS on the V.24 Interface Control menu, and INTERFACE, FLAGS, and CRT on the Trigger menus.

For these fields, it does not matter whether HEX is ON or OFF.

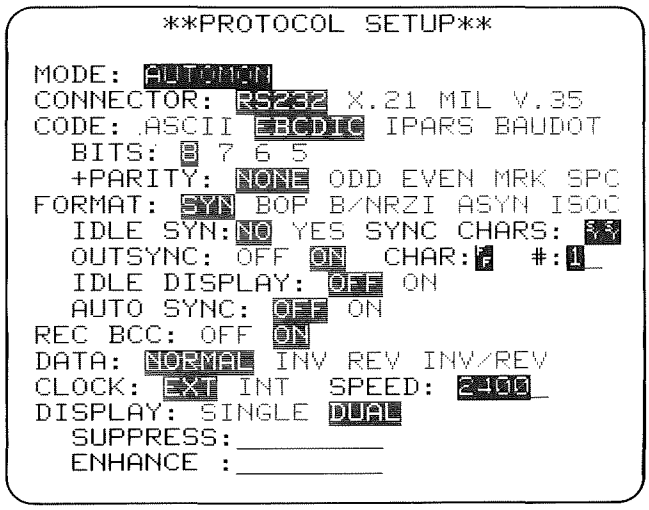


Figure 6-1 The default Protocol Setup menu.

6
OPERATING MODE SELECTIONS

To obtain the Protocol Setup menu, press the PROG key, then numeral 0 (zero). Immediately the menu appears in its default setup, as shown in Figure 6-1. Since the default mode is AUTOMONitor, you do not have to make a single selection on this screen to monitor data. Simply use one of the front-panel interfaces to connect to a live data line, and press RUN. The unit will analyze the line characteristics, configure itself automatically, and begin to monitor. See Section 10 for a discussion of the Automonitor mode.

Or you can configure the Protocol Setup screen manually. On lines three through fourteen of this menu you can choose all the parameters the COMSTATE I needs to monitor data. This section of the manual covers lines three and four. The rest of the essential parameters are explained in Sections 7 through 9.

You can store particular configurations of the Protocol Setup menu in the Test Library. Once a setup is saved, you can call it up automatically from the Test Library menu, discussed in Section 28.8.

6.1 MODE

The first selection on the Protocol Setup menu is MODE. On this line you select the type of operation you intend to perform with the COMSTATE I.

MODE is a rotating-window field. To see selections, press the ROLL key. (SHIFT ROLL reverses the order of rotation.)

Available modes are AUTOMON (automonitor), MON (monitor), TEST DCE, TEST DTE, and REANALYZE.

Select AUTOMON if you are not certain of the line characteristics. Connect to an active data line. When you press RUN, the unit will test samples of data, autoconfigure, and begin to monitor. Once the unit is configured, change the MODE selection to MON, TEST DCE, or TEST DTE. This is to prevent the unit from autoconfiguring every time you go into Run mode.

Select MON if you intend simply to monitor data, and you wish to enter the configuration parameters yourself. When you connect the COMSTATE I to a data

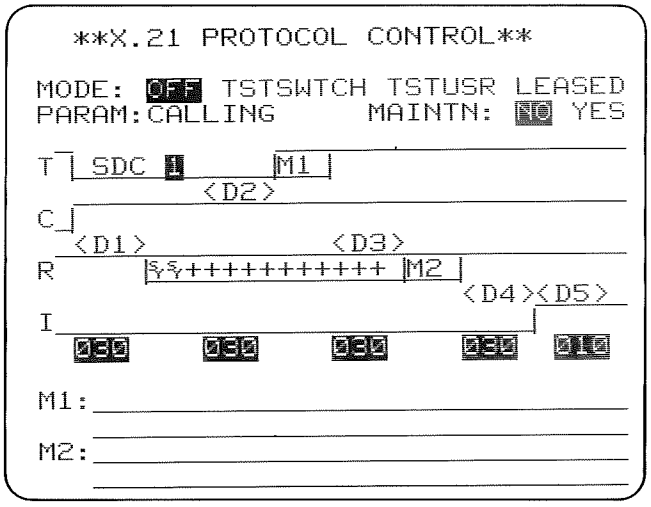


Figure 6-2 The X.21 Protocol Control menu (PROGRAM C).

line using a T cable or one of the adaptor cables, you can monitor the line without interfering with the transmissions. For interactive testing, choose either TEST DCE or TEST DTE depending on the particular type of communication device you are testing.

When REANALYZE is selected in the rotating MODE field, as soon as Run mode is entered the entire 64-kilobyte data buffer from beginning to end is routed to simulated (software) receivers that treat the data as though it were line data. The eight triggers are enabled. A test or a series of tests can be run against the captured data in this mode.

The appropriate LED in the COMSTATE STATUS area of the front panel will light as you make your MODE choice and go into Run mode.

6.2 CONNECTOR

Select the connector appropriate for your system on the fourth line of the Protocol Setup menu. The selections are RS232, X.21, MIL, and V.35. The default is RS232. RS-232/V.24 and MIL use the upper interface connector on the front panel of the COMSTATE I. X.21 and V.35 use the lower, "generic" connector in combination with one of the adaptor cables supplied with your unit.

The red LEDs in the Interface Access area of the front panel indicate whether the RS-232 or X.21/V.35 connector is active. They do not, however, designate whether the COMSTATE I is conducting RS-232 or X.21 control lead activity. For example, to run X.21BIS, you would use the RS-232 connector and select RS232 on the Program 0 screen. During operation the RS-232 LED would be on. But you would select one of the X.21 modes on the X.21 Protocol Control (Parameter C) screen, and in Run mode the unit would monitor or perform X.21 calling and clearing sequences. For more detail on X.21 and X.21BIS operation, see Section 6.3.

MIL designates MIL-188 operation, which inverts all signals on the data leads, including idle. When you select MIL there is no need to invert data (using INV in the DATA field; see Section 8.1). MIL does not affect clock.

6.3 SELECTING X.21 OR X.21BIS OPERATION

The COMSTATE I defaults into RS-232/V.24 operation, but you can easily modify the setup to monitor or test standard X.21 or X.21 BIS systems. First select the appropriate connector on the Protocol Setup menu: the 15-pin X.21 connector for standard X.21 operations, or the 25-pin RS-232/V.24 connector for X.21 BIS operations.

Activate the COMSTATE I's X.21 operations on the X.21 Protocol Control menu (press PROGRAM followed by "C"). The menu is shown in Figure 6-2. Select MODE: TSTSWTCH, MODE: TSTUSR, or MODE: LEASED to activate the X.21 operations. MODE: OFF leaves the unit in RS-232/V.24 operation.

For more detail on X.21 operation and the X.21 Protocol Control menu, see Sections 23 and 25.

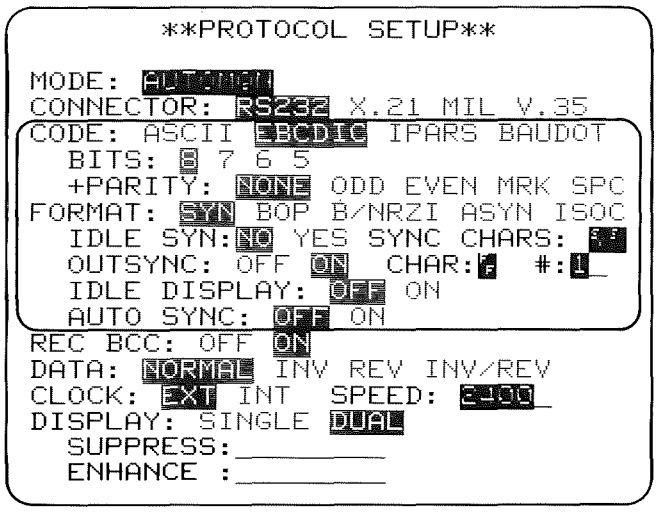


Figure 7-1 CODE and FORMAT fields define the data transfer protocol.

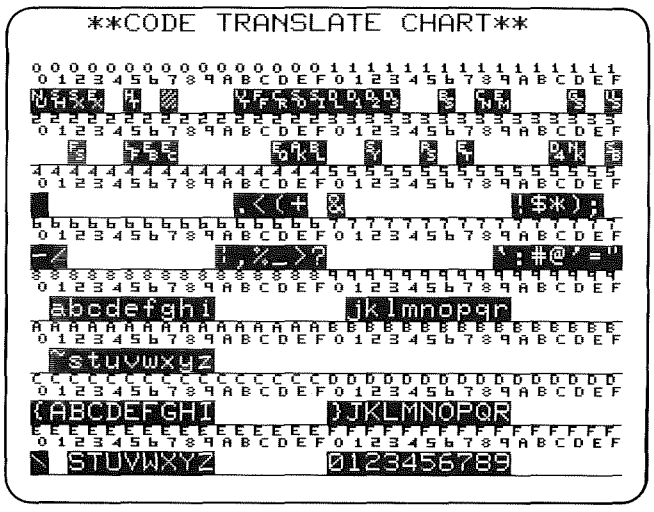


Figure 7-2 The Code Translate Chart (PROGRAM E).

7
CODE AND FORMAT SELECTIONS

This section covers the CODE and FORMAT sections of the Protocol Setup menu (lines five through twelve in Figure 7-1).

7.1 CODE (Line 5)

The standard code selections, as shown in Figure 7-1, are ASCII, EBCDIC, IPARS, and BAUDOT. Your unit may have different codes in the third and fourth positions of this field if special option codes have been installed. The optional codes are: EBCD (Option 4), SELECTRIC (Option 5), XS-3 (Option 6), UT200 (Option 7), and EXTERNAL BCD (Option 8).

If you want to know the hexadecimal equivalent of a character for a certain code, simply select the code on the Protocol Setup menu, then call up the Code Translate Chart (Program E). The Code Translate Chart shows the hexadecimal value of each alphanumeric, special, and control character for that particular code. The chart is adjusted for the number of information bits and the parity (if any) currently selected on the Protocol Setup menu. Therefore, you should always be sure to make the appropriate CODE, BITS, and PARITY selections before you look at the Code Translate Chart.

Figure 7-2 shows a Code Translate Chart for 7-bit, odd-parity ASCII. Translation charts for all the COMSTATE I's standard codes may be found in Appendix A.

7.2 INFORMATION BITS (Line 6)

Identify the number of information bits for the selected code in the BITS field. Do not include the parity bit.

7.3 PARITY (Line 7)

In the PARITY field select the type of parity used in the system being tested. The choices are NONE, ODD, EVEN, MARK, and SPACE. The parity bit is additional to the information bits.

When a PARITY selection other than NONE is used, every data character received with a parity error will be displayed with a bar through it.

NOTE: 8-Bit odd or 8-bit even parity is a functional choice, but the COMSTATE I cannot handle 8 bits plus mark or space parity.

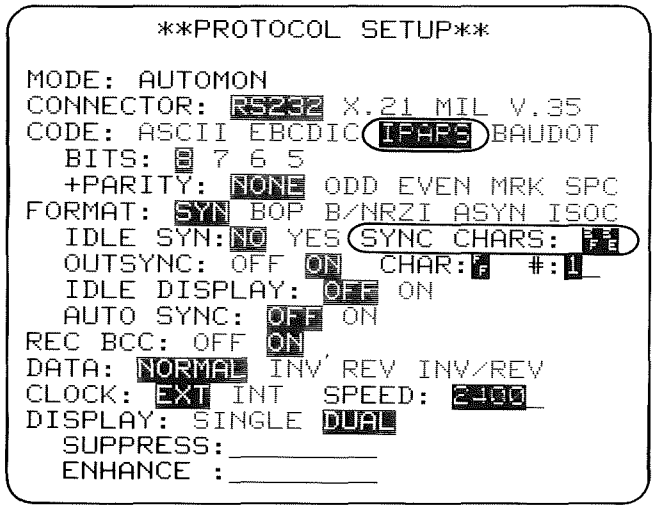


Figure 7-3 SYNC CHARS default to 3F 3E (hex) when IPARS is selected.

TABLE 7-1
DEFAULT SYNCHRONIZATION CHARACTERS (Note 1)

Code	Menu Display	Sync Chars. (hex)
EBCDIC	SY SY	32 32
ASCII	SY SY	16 16
IPARS (Note 2)	3F 3E	3F 3E
BAUDOT	----	----
EBCD	SY SY	3D 3D
SELECTRIC	----	----
XS-3	35 35	35 35

Note 1: For standard and optional codes.
Note 2: For IPARS, the mnemonic entry SY SY will result in an invalid synchronization pattern.

7.4 FORMAT (Line 8)

The FORMAT selection field allows you to program the COMSTATE I correctly for the protocol to be monitored. The selection on the FORMAT line determines what choices are allowed on the next four lines.

7.4.1 SYNC Selections

Selecting SYNC for FORMAT results in a group of choices on Lines 9 through 12, as shown in Figure 7-1. Choose SYNC for BISYNC.

(a) IDLE SYN (Line 9). The COMSTATE I can transmit a single repeated synchronization character when idle, rather than the normal idle character. Select YES in this field to idle this synchronization character, NO for the normal idle character. The default is NO.

(b) SYNC CHARS (Line 9). This data-entry field determines the synchronization pattern for synchronous data protocols. The synchronization characters default to SY SY on the menu as shown in Figure 7-1, except for IPARS, for which the actual value of SY1 SY2 (3F 3E, hex) is the default (see Figure 7-3). (With IPARS selected, the mnemonic entry SY SY will give an invalid synchronization pattern.)

The COMSTATE I automatically checks the code chart and selects the proper synchronization pattern for the selected code. Adjustments for your parity selection are also automatic. For example, SY in odd-parity ASCII is 16 (hex) but in even-parity ASCII the COMSTATE I converts SY to 96 (hex). For most cases, therefore, you will not have to make any entry in the SYNC CHARS field.

The default synchronization patterns for the various standard and optional codes in the COMSTATE I are listed in Table 7-1.

Any other one- or two-character sequence may be entered, using alphanumeric keys, control characters, or hexadecimal. The character entered will be adjusted for parity (if PARITY is selected) unless the entry is made in hexadecimal. For hexadecimal entries no parity adjustment is made.

> NOTE: If HEX is ON while you are entering the synchronization pattern, you must adjust your entry to account for parity.

To enter a one-character synchronization pattern, position the cursor on the first character in the SYNC CHARS field and depress the CLEAR key; then enter the desired character.

(c) OUTSYNC (Line 10). OUTSYNC causes a receiver to go out of synchronization if it finds a certain number of the specified character in the data stream. The default OUTSYNC sequence is one pad (FF, hex) character, as shown in Figure 7-1. Any character may be entered in the CHAR field. The number field (#) is a decimal field. It allows you to specify how many times the character must occur consecutively (from one to 99 times) before OUTSYNC occurs.

In transparent text, there is the possibility that legitimate data FF (hex) will occur, making it necessary to change the OUTSYNC character or turn OUTSYNC off. Also, the block check character may occasionally mimic the OUTSYNC character. The latter problem is usually solved by increasing the number of OUTSYNC characters to 2.

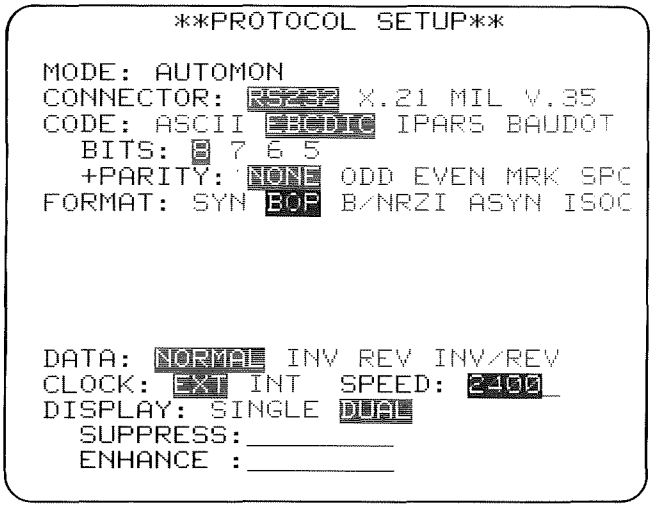


Figure 7-4 When you select BOP, lines 10-13 disappear.

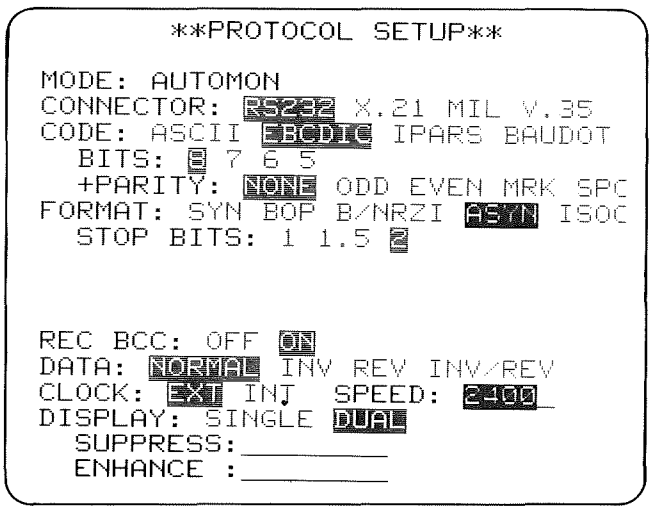


Figure 7-5 ASYN or ISOC formats let you select STOP BITS.

(d) IDLE DISPLAY (Line 11). OFF suppresses display of idle characters from the time the receivers go out of synchronization until they see the synchronization pattern again. If you select ON, the idle characters will be displayed, but in low intensity.

(e) AUTO SYNC (Line 12). AUTO SYNC allows the COMSTATE I to recognize a synchronization pattern at any time even though the receiver logic may "think" it is already in synchronization. AUTO SYNC should only be used with a two-character synchronization pattern. When AUTO SYNC is enabled, the logic constantly tests for the two-character pattern on a bit-by-bit basis. When a match is found, it becomes the new reference point for character framing. AUTO SYNC thus eliminates the need to "bit shift" the data to find synchronization.

In normal synchronous operation, OUTSYNC is on and AUTOSYNC is off. In this configuration, once the receivers go out of sync, the receiver logic tests for the two-character sync pattern on a bit-by-bit basis, just as when AUTOSYNC is set on. Enabling AUTOSYNC means that the bit-by-bit search is conducted all the time, even when the receivers are already in sync.

AUTO SYNC is especially useful where there is no particular end of message character (OUTSYNC), or where one block of data follows another by less than a full character interval. AUTO SYNC will detect the synchronization pattern even though it is skewed from the previous block and display the following data correctly.

NOTE: If AUTO SYNC is on, the second (and following) synchronization character will not be displayed when the synchronization pattern is found, but the first one may show up either as SY or as a "garbage" character.

7.4.2 Bit-Oriented Protocols

The FORMAT:BOP selection selects bit-oriented protocols that use 7E framing and zero insertion such as X.25, X.75, and SDLC. BOP/NRZI enables the COMSTATE I to decode BOP transmissions with Non-Return-to-Zero Inverted encoding.

In BOP protocols, the synchronization Flag pattern, conditions for OUTSYNC, and block check calculation are always defined, so Lines 10 through 13 on the menu will be blank (see Figure 7-4). CONTROL-HEX is automatically set ON (though the HEX LED does not light) so that protocol characters, when they do not correspond to ASCII-keyboard characters, are shown in hexadecimal, while characters in the data stream are decoded.

7.4.3 Asynchronous Operation

For asynchronous start-stop data, choose FORMAT:ASYNC. Then you may choose among 1, 1.5, and 2 STOP BITS on line 9, as shown in Figure 7-5. For asynchronous start-stop data with clock on the interface (isochronous operation), choose ISOC for FORMAT. Select the correct number of STOP BITS and CLOCK. If clock is not provided on the interface, select CLOCK: INT on line 15.

NOTE: In ASYNC operation, the COMSTATE I detects framing errors and displays them as blinking characters with a line through them.

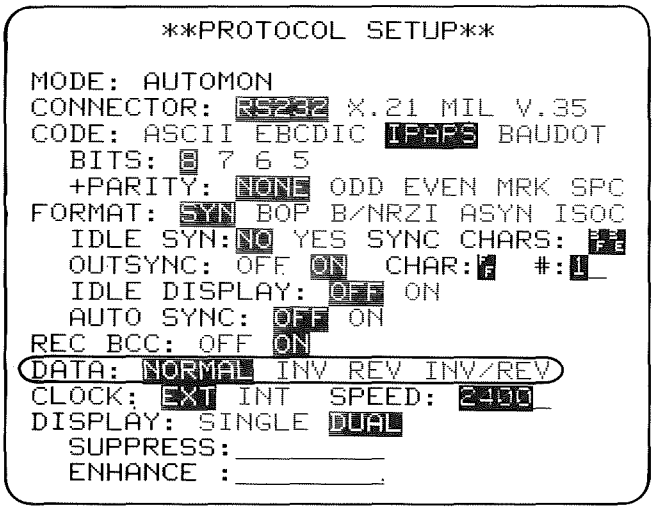


Figure 8-1 The DATA field.

TABLE 8-1
DATA FIELD SELECTIONS
IN X.21/V.35 AND RS-232 OPERATION

DATA Selection	Logic 1	Logic 0	Least Sig. Bit	Idle
NORMAL	-3(or.3) V	+3(or.3) V	First	-3(or.3) V
INV	+3(or.3) V	-3(or.3) V	First	-3(or.3) V
REV	-3(or.3) V	+3(or.3) V	Last	-3(or.3) V
INV/REV	+3(or.3) V	-3(or.3) V	Last	-3(or.3) V

8
SYSTEM CHARACTERISTICS

8.1 DATA (Line 14)

The selections in this field (Figure 8-1) allow you to use the COMSTATE I for nonstandard systems. You must know the characteristics of your system in order to make the correct choices.

For X.21/V.35 and RS-232/V.24 operation, when you select NORMAL the COMSTATE I is set up to idle constant MARK and to send and receive data in which the first bit is the least significant bit.

For X.21 and V.35 A leads, the COMSTATE I defines logic 1 (MARK or OFF) as more negative than -0.3 V with respect to the B lead. Logic 0 (SPACE or ON) is defined as more positive than +0.3 V with respect to the B lead.

For RS-232 operation, the COMSTATE defines logic 1 as more negative than -3 V and logic 0 as more positive than +3 V. When you select INV, the COMSTATE I expects the logic to be inverted: that is, logic 1 is +3 V and logic 0 is -3 V. The COMSTATE I inverts the logical interpretation of the voltages, not the voltages themselves. The start bit still signals the transition from negative to positive voltage. Stop bit and idle are still negative voltages, but now they are read as logic 0 instead of logic 1.

When you select REV, the COMSTATE I expects the order of the information bits to be reversed: the first bit sent and received is the most significant information bit. If parity has been selected, the parity bit will still follow the information bits.

When REV is selected in ASYNC operation, the START bit is still first, followed by the information bits in reverse order, then the parity bit, and the STOP bit(s). Table 8-1 summarizes the DATA selections.

NOTE: Neither INV nor REV affects the idle configuration.

If MIL is selected as the CONNECTOR, the COMSTATE I expects the entire data-lead bit stream to be inverted, including start/stop bits and idle characters. The COMSTATE I expects a constant MARK idle at +3 V, and the start bit is a transition to negative

voltage. Logic 1 is +3 V and logic 0 is -3 V. For MIL data there is no need to select INV in the DATA field. MIL does not affect clock.

8.2 CLOCK (Line 15)

If clock is provided on the RS-232/V.24 interface (Pins 15 and 17 or 24), you may select either INT or EXT. EXT allows the COMSTATE I's data receivers to use the external clock. The external clock must be a 1 x baud clock with the negative-going transition occurring at the middle of the data-bit period.

For systems where there is no external clock, select INT. The COMSTATE I's internal clock logic will regenerate clock information from the data. When INT has been selected, you must also select speed.

8.3 SPEED (Line 15)

This decimal field appears for your reference at all times, but is operative only when INTernal clock has been selected. The correct speed of the system must be entered here for clock information to be regenerated from the data. You may use up to five digits or four digits and a decimal point. The maximum internally generated speed is 28.8 kbps. If clock is provided externally, the COMSTATE I will monitor up to 64 kbps.

NOTE: See Appendix I for a list of the data speeds that can be selected precisely on the parameter menus. If other speeds are entered, they will be approximated only.

9 BLOCK CHECK CALCULATIONS

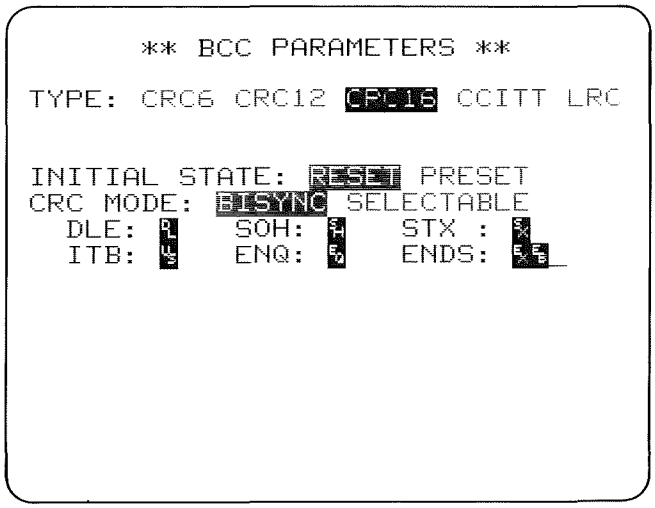


Figure 9-1 The BCC Parameters menu (PROGRAM B).

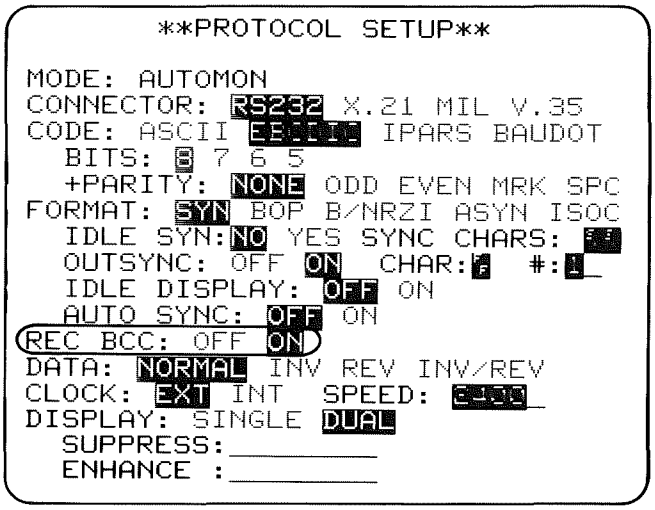


Figure 9-2 Block checking is enabled from the Protocol Setup menu.

9
BLOCK CHECK CALCULATIONS

The COMSTATE I performs a variety of standard and nonstandard block check calculations on both received and transmitted data. You can test for unique applications by altering the parameters of the block check calculation on the BCC Parameters menu (Program B, shown in Figure 9-1).

9.1 RECEIVED BLOCK CHECKING

Received block checking is enabled from line 13 of the Protocol Setup menu (Program 0), REC BCC: OFF ON (Figure 9-2). Actual control of the block check parameters is achieved from the BCC Parameters menu (Program B).

For some formats and codes, REC BCC does not appear on the Protocol Setup menu. Received block checking is automatically OFF if BAUDOT, which does not support block checking, is selected. Block checking is automatically ON for the formats that have well-defined block check sequences, namely, BOP and BOP/NRZI.

When REC BCC is OFF, the actual block check characters received by the COMSTATE I on both TD and RD (or T and R for X.21) are displayed, but no calculations are performed on received data.

When REC BCC is ON, the COMSTATE I performs block check calculations on all received data according to the parameters set on the BCC Parameters menu. When a block check is Good, a low-intensity reverse-image "G" is displayed in place of the last block check character; when a block check is Bad, a full-intensity reverse-image "B" is displayed.

The COMSTATE I does not display Aborts except in BOP and BOP/NRZI. For these formats, the COMSTATE I displays a full-intensity, reverse-image "A" when it detects seven consecutive "1" bits.

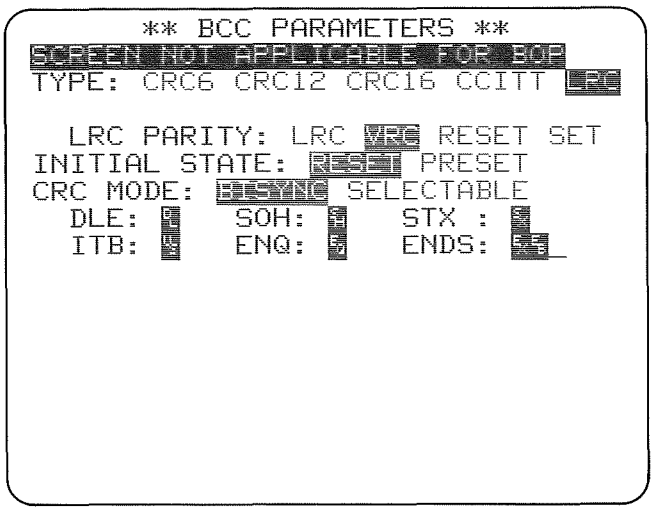


Figure 9-3 The BCC Parameters menu does not operate for bit-oriented protocols.

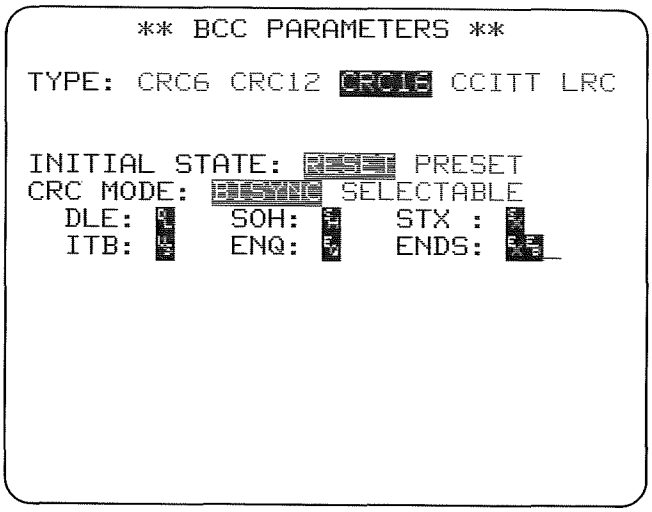


Figure 9-4 Default BCC Parameters menu for EBCDIC code in SYNC or ASYNC format.

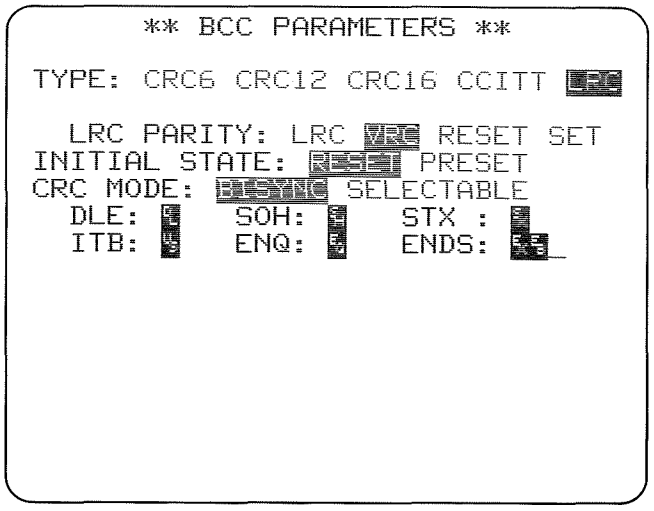


Figure 9-5 Default BCC Parameters menu for ASCII code in SYNC or ASYNC format.

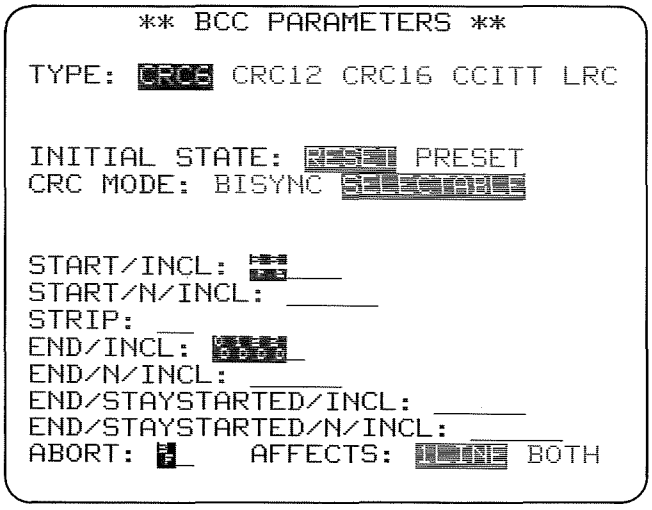


Figure 9-6 Default BCC Parameters menu for IPARS code in SYNC or ASYNC format.

9.2 TRANSMITTED BLOCK CHECKING

Transmitted block checks are enabled in the TYPE field of the Interactive Test menu (Program 7). If "N" is selected, no block check will be transmitted.

NOTE: If "N" is selected when the unit is set up for a bit-oriented protocol (BOP or B/NRZI in the Program 0 FORMAT field), the transmitters will send an abort.

If the Interactive Test menu has been set to transmit block check characters, BCCs will be transmitted in accordance with the parameters in effect on the BCC Parameters menu.

9.3 DEFAULT BLOCK CHECK CALCULATIONS

The COMSTATE I automatically defaults to specific standard block check calculations depending on the code and format selections made on the Protocol Setup menu. Table 9-1 summarizes the default BCC settings for the various standard codes and formats supported by the COMSTATE I.

The actual equations used by the COMSTATE I in BCC calculations are defined in Table 9-2.

9.3.1 BOP and BOP/NRZI Formats

For Bit-Oriented Protocols (BOP and BOP/NRZI), the COMSTATE I defaults to the BCC calculations standard for the format selected. The parameters for these calculations cannot be changed on the BCC parameters screen (shown in Figure 9-3). You may make changes on the screen for execution if another format (such as ASYNC) is selected. The changes will remain on the BCC Parameters menu when you change formats.

NOTE: Changing format selection has no effect on the BCC Parameters menu, but changing codes (from ASCII to EBCDIC, for example) will cause the BCC Parameters menu to display the default parameters for the new code.

9.3.2 SYNC and ASYNC Formats

When SYNC or ASYNC format is selected on the Protocol Setup menu, the COMSTATE I defaults into BISYNC or SELECTABLE CRC mode depending on the code selected in the Protocol Setup menu. The various default configurations found on the BCC Parameters menu for SYNC or ASYNC format are detailed below.

(a) EBCDIC or ASCII Code. Selecting EBCDIC or ASCII code in SYNC or ASYNC format results in the default parameters shown in Figures 9-4 and 9-5. Both EBCDIC and ASCII default into BISYNC CRC mode, but EBCDIC uses a CRC-16 calculation while ASCII uses an LRC calculation to determine BCC. You may redefine the values of the BCC control characters using alternate control characters, standard alphanumerics, or hexadecimal characters. You may also indicate that the control character does not exist by leaving the field blank (see Section 9.5 on BISYNC CRC Mode Operation).

(b) IPARS. Selecting IPARS code in SYNC or ASYNC format results in the default BCC parameters shown in Figure 9-6. IPARS defaults into SELECTABLE CRC mode and uses CRC-6 to calculate BCCs. Any of the BCC parameters may be changed to meet specific applications.

TABLE 9-1
COMSTATE I DEFAULT BLOCK CHECK CALCULATIONS

Code	Format	Is Screen Appl.?	Type	BCC Starts	BCC Resets on (Note 7)	Ignores (Strips from Calculations)	BCC Ends with	Aborts (No BCC)
Standard Codes								
EBCDIC	SYNC	YES	CRC-16	Defaults to Bisync CRC Mode Operation. See Section 9-5 on Bisync CRC Mode Operation				
	ASYNC	YES	CRC-16					
	BOPs (Note 1)	NO	---					
ASCII	SYNC	YES	LRC	Defaults to Bisync CRC Mode Operation. See Section 9-5 on Bisync CRC Mode Operation				
	ASYNC	YES	LRC					
	BOPs (Note 1)	NO	---					
IPARS	SYNC	YES	CRC-6	First bit after SY1 SY2 (3F 3E)	Next bit after CRC	---	EOM-PB(3D) EOM-1 (0D) EOM-C (1D) EOM-U (2D)	SY1 (3F)
	ASYNC	YES	CRC-6					
	BOPs (Note 1)	NO	---					
BAUDOT	SYNC			NO DEFAULT BCC				
	ASYNC							
	BOPs (Note 1)							
Optional Codes								
Transmit: EBCD REV EBCD SELECTRIC (Note 2)	SYNC	YES	LRC	First text character	EOT (resets LRC) EBCD (3C) R-EBCD(0F) SEL (3C)	# (at start of message) EBCD (34) R-EBCD(0B) SEL (30)	ETB EBCD (5E) R-EBCD(1E) SEL (5E)	EOT EBCD (3C) R-EBCD(0F) SEL (3C)
	ASYNC	YES	LRC					
	BOPs (Note 1)	NO	---					
Receive: EBCD REV EBCD SELECTRIC (Note 3)	SYNC	YES	LRC	First text character (Note 4)	EOT EBCD (3C) R-EBCD(0F) SEL (3C)	---	ETB EBCD (5E) R-EBCD(1E) SEL (5E)	EOT EBCD (3C) R-EBCD(0F) SEL (3C) (Note 5)
	ASYNC	YES	LRC					
	BOPs (Note 1)	NO	---					
XS-3	SYNC	YES	LRC	SOM (40)		---	EOM (55) (not included in BCC)	---
	ASYNC	YES	LRC					
	BOPs (Note 1)	NO	---					

(continued)

TABLE 9-1 (continued)

Code	Format	Is Screen Appl.?	Type	BCC Starts	BCC Resets on (Note 7)	Ignores (Strips from Calculations)	BCC Ends with	Aborts (No BCC)
HEX	SYNC	NO						
	ASYNC	NO						
	BOPs (Note 1)	NO			NO DEFAULT BCC			
UT-200	SYNC	YES	LRC					
	ASYNC	YES	LRC	SOH		SYN	ETX	
	BOPs (Note 1)	NO	---	(01) (Note 6)	---	(16)	(03)	---

Note 1: BOPs = Bit Oriented Protocols, including: BOP and B/NRZI.
Note 2: Parity bit of LRC = LRC of all parity bits in transmission.
Note 3: LRC ignores parity bits.
Note 4: The bid character (#) at start of first transmission is not included in calculation, but thereafter all bid characters are included until an EOT is found.
Note 5: An EOT on one side of the line resets the other side of the line also.
Note 6: Note: Initial State is Preset (all 1's).
Note 7: Calculations are reset whenever OUTSYNC or AUTOSYNC occurs.

Table 9-2
Block Check Polynomials

BCC Type	Block Check Polynomial
CRC-16	$X^{16} + X^{15} + X^2 + 1$
CRC-CITT	$X^{16} + X^{12} + X^5 + 1$
CRC-12	$X^{12} + X^{11} + X^3 + X^2 + X + 1$
CRC-6	$X^6 + X^5 + 1$

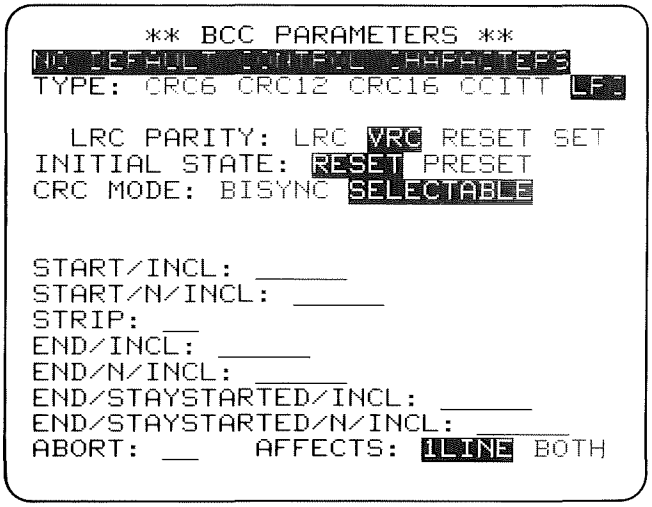


Figure 9-7 Default BCC Parameters menu for BAUDOT code in SYNC or ASYNC format.

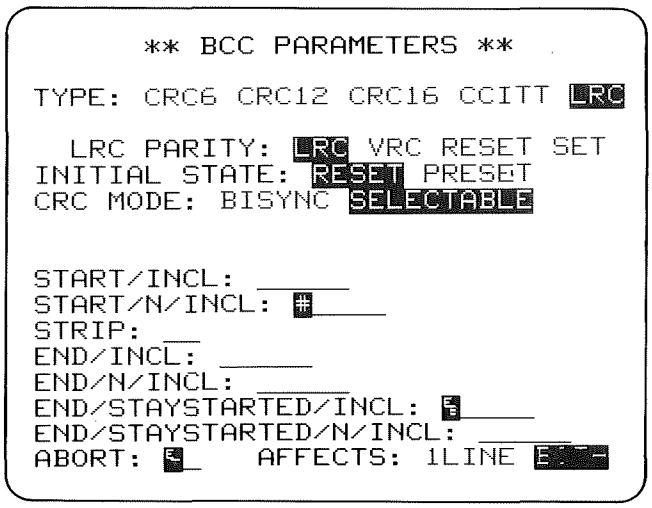


Figure 9-8 Default BCC Parameters menu for EBCD or SELECTRIC Code in SYNC or ASYNC format.

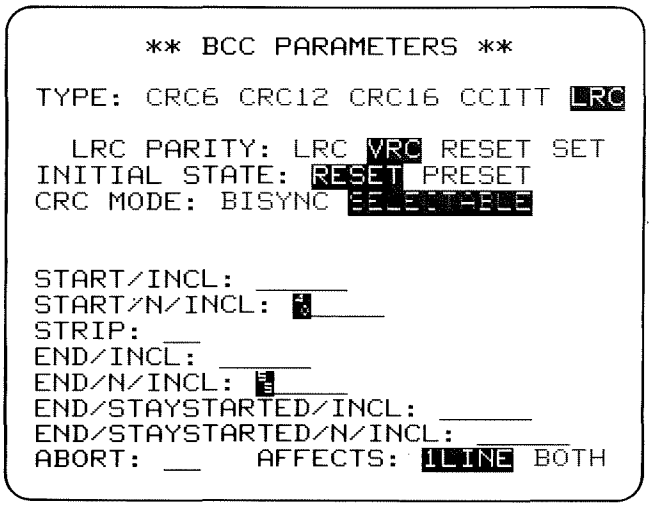


Figure 9-9 Default BCC Parameters menu for XS-3 Code in SYNC or ASYNC format.

(c) BAUDOT. Baudot does not support block checking, thus there are no default settings. If you select Baudot, the BCC Parameters menu displays the message shown in Figure 9-7.

(d) EBCD, XS-3, or SELECTRIC options. Selecting EBCD, or SELECTRIC code for SYNC or ASYNC format will result in the default BCC parameters shown in Figure 9-8. Selecting XS-3 for SYNC or ASYNC format will result in the default shown in Figure 9-9. All four codes default into SELECTABLE CRC mode and use an LRC calculation to determine BCCs. Any of the BCC parameters may be changed to meet specific applications.

9.4 BCC PARAMETERS MENU FIELDS

The BCC Parameters Menu (Program B) controls and displays the values of the COMSTATE I's block check parameters. These parameters are arrayed in fields on the BCC menu. The meanings of the BCC parameter fields are found in Table 9-3.

Entries on the menu may be made in either alphanumeric or hexadecimal characters. In the START/INCL field only, characters may also be entered in the NOT EQUAL format.

9.5 BISYNC CRC MODE OPERATION

The COMSTATE I supports an expanded subset of IBM's "Binary Synchronous Control Procedures" (BISYNC), giving the COMSTATE I greater flexibility in handling a wide variety of BISYNC-type applications including Burroughs, Honeywell, Univac, ISO-1175, and others.

You cannot specify whether control characters are included or excluded from the BCC calculation in BISYNC CRC mode. You can, however, specify the values of the six BISYNC control characters (DLE, ITB, SOH, ENQ, SOT, and ENDS) which appear on the BCC Parameters menu with default character values already assigned (see Figure 9-4). The ENQ control character signifies that a BCC calculation and BCC will not follow. The ENDS control character(s) indicates that a BCC calculation and a BCC will follow. (The ENDS field will designate up to three alphanumeric or control characters as END characters.) You may redefine the values of the BCC control characters using alternate control characters or standard alphanumeric characters. Hexadecimal entries will not be accepted. Clearing a field indicates that the control character does not exist. If in your protocol the IUS (Intermediate Unit Separator) does not perform an ITB function, the IUS should

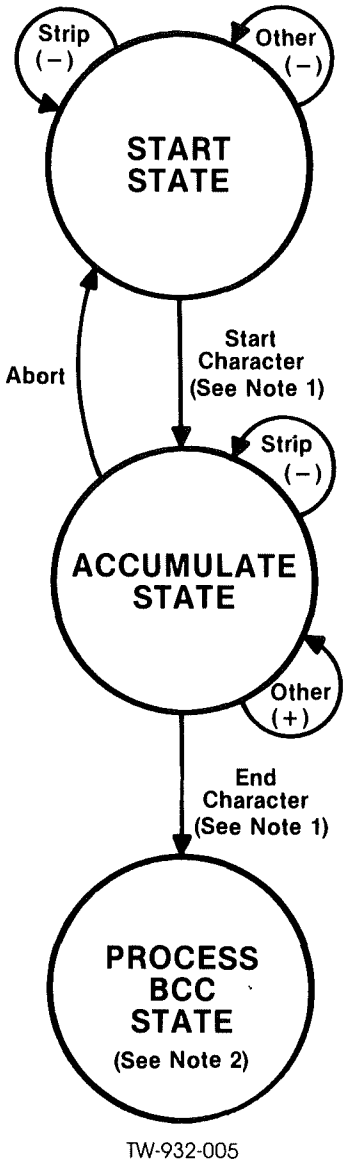


Figure 9-10 SELECTABLE MODE State Diagram:
(+) means the character is included in BCC calculation;
(-) means the character is not included in BCC calculation.

NOTE:

1. Any Start or End character can be either included in or excluded from BCC accumulation.

2. PROCESS BCC STATE does the following:
   a. Calculates and displays BCC result
   b. BCC remainder is reinitialized
   c. If end character was a STAYSTARTED character, returns to ACCUMULATE STATE.
   d. If end character was not a STAYSTARTED character, returns to START STATE.

be cleared from the ITB field (with the CLEAR key). Similarly, if DLE does not activate transparent text mode in your protocol, the DLE field on the BCC Parameters menu should be cleared.

9.6 SELECTABLE CRC MODE

SELECTABLE CRC mode offers a simpler default setup than BISYNC, but allows even greater user control over the BCC parameters. If your protocol supports transparent data, use BISYNC, not SELECTABLE CRC mode. BISYNC, with its Data Link Escape (DLE) character, can handle transparent data.

A SELECTABLE CRC mode state diagram is presented in Figure 9-10. In SELECTABLE CRC mode, unlike BISYNC, you may choose multiple Start, End, Intermediate End, Strip, and Abort characters and indicate whether to include or exclude the characters in the BCC accumulation.

A typical BCC Parameters Menu in SELECTABLE CRC mode is illustrated in Figure 9-11. The menu supports up to two characters in the STRIP and ABORT fields, and up to five characters in each of the other fields.

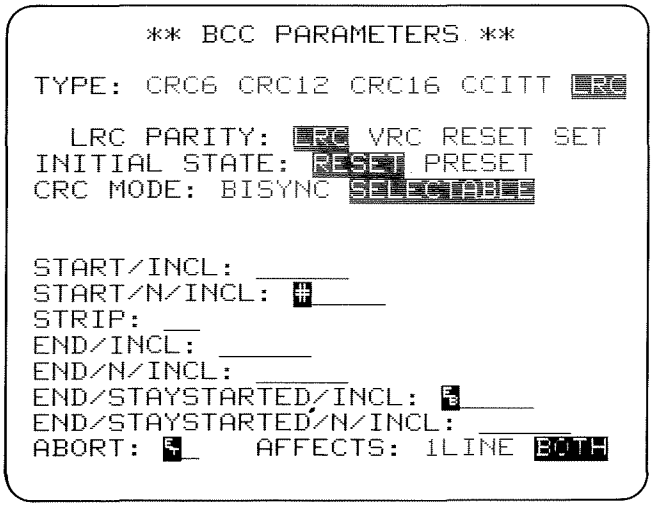


Figure 9-11 BCC Parameters Menu in SELECTABLE mode.

TABLE 9-3
BCC PARAMETERS MENU FIELDS

Line	Field	Meaning
2	(Messages)	All BCC Parameters messages to the operator are displayed on Line 2. See Appendix E for explanation of each message.
3	TYPE	Indicates method of BCC calculation selected. Polynomial expansions of each Type are listed in Table 9-2.
5	LRC PARITY	Displayed when TYPE: LRC is selected. Identifies how the LRC parity bit is being handled. LRC =the result of an LRC on the parity bits within the message VRC =the result of a VRC on the BCC character RESET=Ø SET =1
6	INITIAL STATE	Sets initial state of block check character. RESET = all Ø's PRESET = all 1's
7	CRC MODE	Allows choice between BISYNC and SELECTABLE CRC modes.
8,9	BISYNC control character fields	Data-entry fields displayed for BISYNC CRC Mode only. Allow you to alter the default values for protocol characters used by the COMSTATE I CRC logic. The default values are those standard for the code selected on the Parameters 1 menu. Alphanumeric, hexadecimal, and control characters are all legal.

(continued)

TABLE 9-3 (continued)

Line	Field	Meaning
10	START/INCL	Displayed when SELECTABLE is chosen. Identifies the character(s) on which the COMSTATE 1 initiates BCC accumulation, and includes the character(s) in the accumulation. For this field only, characters may be entered in either normal or NOT EQUAL format.
11	START/N/INCL	Displayed when SELECTABLE is chosen. Identifies the character(s) on which the COMSTATE 1 initiates BCC accumulation, and does not include the character(s) in the accumulation.
12	STRIP	Displayed when SELECTABLE is chosen. Identifies character(s) to be stripped from BCC accumulation.
13	END/INCL	Displayed when SELECTABLE is chosen. Identifies the character(s) on which the COMSTATE 1 ends BCC accumulation, and includes the character(s) in the accumulation. Initiates processing of BCC. Returns to START State when processing is complete (see Figure 9-11).
14	END/N/INCL	Displayed when SELECTABLE is chosen. Identifies the character(s) on which the COMSTATE 1 ends BCC accumulation, and does not include the character(s) in the accumulation. Initiates processing of BCC. Returns to START State when processing is complete (see Figure 9-11).

(continued)

TABLE 9-3 (continued)

Line	Field	Meaning
15	END/STAYSTARTED/INCL	Displayed when SELECTABLE is chosen. Identifies the character(s) on which the COMSTATE I ends BCC accumulation, and includes the character(s) in the accumulation. Initiates processing of BCC. Returns to ACCUMULATE State when processing is complete (see Figure 9-11).
16	END/STAYSTARTED/N/INCL	Displayed when SELECTABLE is chosen. Identifies the character(s) on which the COMSTATE I ends BCC accumulation, but does not include the character(s) in the accumulation. Initiates processing of BCC. Returns to ACCUMULATE State when processing is complete (see Figure 9-11).
17	ABORT	Displayed when SELECTABLE is chosen. Identifies character(s) on which the COMSTATE I aborts BCC accumulation and returns to START State (See Figure 9-11). Indicates whether BCC accumulation has been aborted on one or both lines.

10
AUTOMONITOR

The Automonitor feature enables the user to monitor a data-communication line of unknown speed, code, and protocol. In this mode the COMSTATE I takes a sample of data, analyzes it, displays its reading of each characteristic, and shifts into Run mode and begins monitoring.

10.1 AUTOMONITOR MODE

AUTOMONitor is the default selection in the first field at the top of the Protocol Setup (Program 0) screen. (See Figure 6-1.) This means that AUTOMON is the default mode in the unit. When the operator powers the unit on and presses PROGRAM, RUN, the COMSTATE I begins its autolearn sequence.

After the first monitoring run, press PROGRAM, 0, to call up the Protocol Setup screen. Do any fine tuning to the unit's configuration. With the cursor in the MODE field, repeat the ROLL key to change the selection to MONitor or to one of the emulate modes. If you keep the AUTOMON selection, the unit will autoconfigure every time it goes into Run mode.

10.2 AUTO CONFIGURE SCREEN

When a COMSTATE I with AUTOMON selected enters Run mode it displays the Auto Configure screen shown in Figure 10-1. A Status line appears at the bottom of this screen, identifying the stage in the auto-configure procedure. The first stage is CAPTURING SAMPLE 0 (see Figure 10-1). The unit remains in this stage until 2 kilobytes of data have been captured or until 20 seconds have elapsed, whichever comes first. Now the unit begins its learning process on the captured data. If the captured data includes 100 bytes with logical transitions, the Status line changes to CONFIGURING UNIT. (See Figure 10-2.) If there are fewer bytes with transitions, the unit returns to sampling data, this time CAPTURING SAMPLE 1; and so on until a good data sample is found.

If a peculiarity in the sample makes a complete analysis impossible even after the CONFIGURING phase has been reached, the unit will revert to the CAPTURING phase for another sample. Any parameters identified previously are kept.

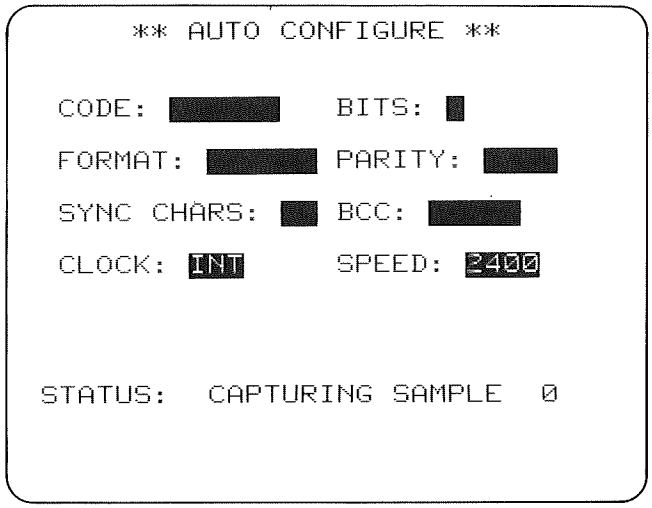


Figure 10-1

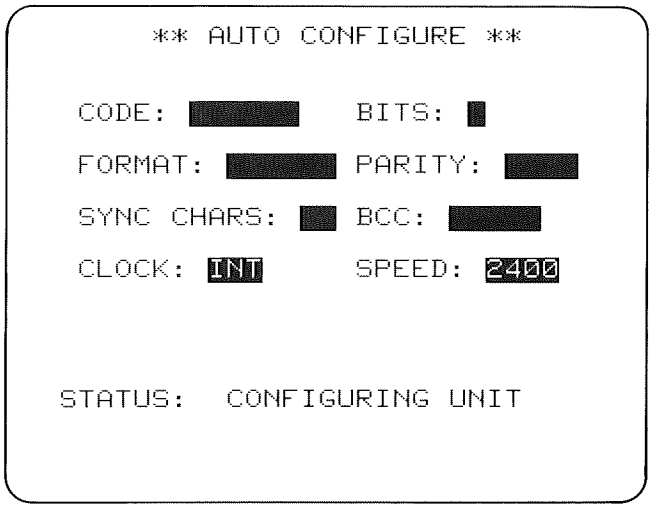


Figure 10-2

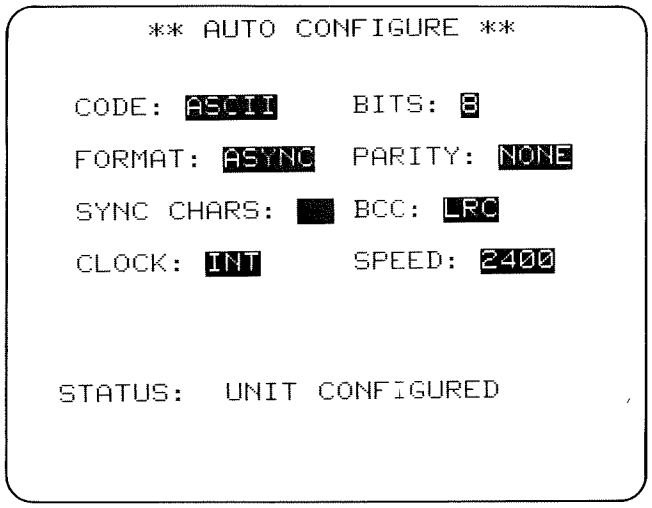


Figure 10-3

The initial data sample is very important. If at any time you wish to restart the autolearn process and try for a "better" initial data sample, simply press RUN.

CLOCK and SPEED (see Figure 10-1) are analyzed during the capture phase. Other parameters are analyzed during the configuring or "learning" phase. When the unit has arrived at an estimate of all the parameters, the Status changes to UNIT CONFIGURED. The complete set of parameters is displayed for three seconds (see Figure 10-3), and the selections on the PROGRAM 0 screen are updated. At the end of three seconds the unit shifts to Run mode and begins monitoring with its new configuration.

NOTE: Automonitor mode reconfigures the Program 0 screen, but it does not influence the selection in the CONNECTOR field on that screen. The default selection is RS232. This selection must agree with the connector actually in use on the front panel. Automonitor will not see data that arrives via the "wrong" connector. (Other Program 0 fields that Automonitor does not affect are DISPLAY, SUPPRESS, and ENHANCE. See Section 11.)

If the operator presses PROGRAM, 0, while the unit is in the learning phase, the Program 0 screen will be updated to include any parameters already registered on the Auto Configure screen. Entering Run mode, however, will always initialize the autolearn process.

NOTE: Automonitor mode will detect special codes EBCD, SELECTRIC, XS-3, IPARS, and BAUDOT. If one of these codes is detected and that code-option is not installed in the particular unit, the operator will receive this message: UNIT CONFIGURED: CODE NOT INSTALLED. Then the unit will enter Run mode and provide a hexadecimal conversion of all data. ASCII will be the code selected (arbitrarily) on the Program 0 screen.

NOTE ALSO: In order for the unit to configure itself successfully to monitor synchronous data, the sync characters should be preceded by two or more idle-time characters.

IMPORTANT: COMSTATE I's Automonitor mode has been designed to be 1) fast, and 2) 90% accurate. To satisfy the first criterion, the software acts on two assumptions: first, that the protocol is a fairly typical one; and also that the data sample is typical. (For example, an X.25 line without traffic cannot be distinguished from an SDLC line that also merely is idling 7E flags. In the absence of positive evidence to the contrary, the Automonitor logic will "default" to SDLC.) Automonitor is designed as a tool for setting up a piece of test equipment properly, to be used with other tools. These tools include the Program 0 menu and also the operator's own knowledge and experience.

PART III
THE DATA DISPLAY

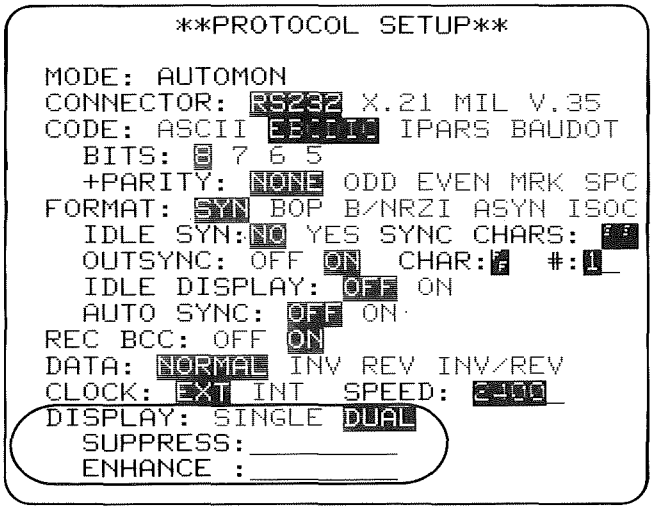


Figure 11-1 The last three fields control the data display.

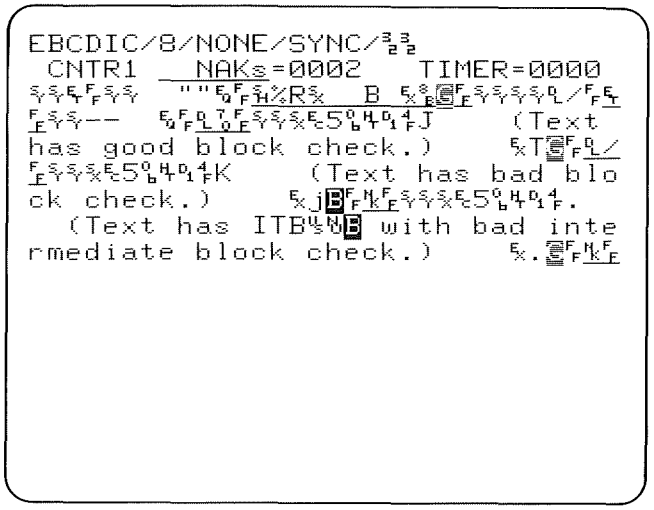


Figure 11-2 SINGLE-line data display (DCE data is underlined).

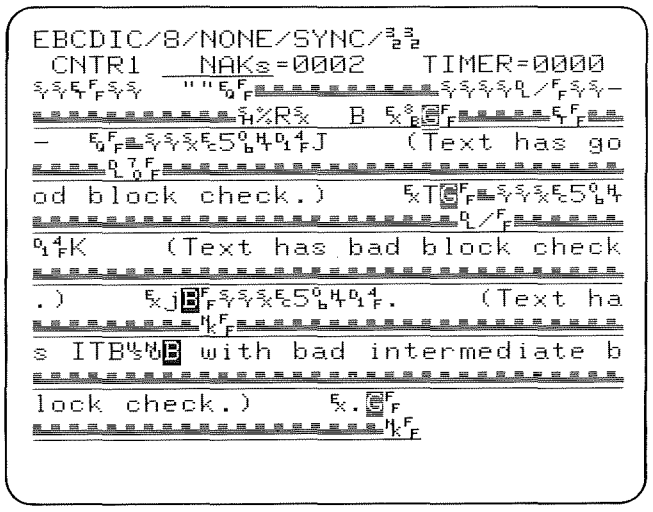


Figure 11-3 DUAL-line data display (DCE data is underlined).

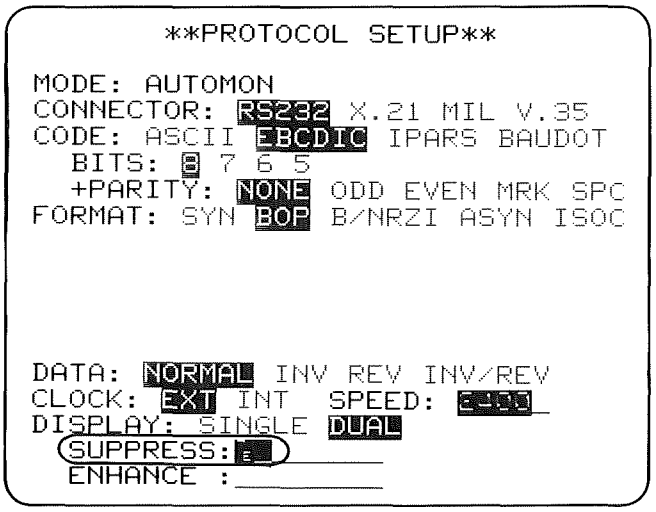


Figure 11-4 Suppressing Flags (7E) in BOP.

11
CONTROLLING THE DISPLAY

The last three fields of the Protocol Setup menu (Figure 11-1) control the format of the data display and data enhancements. The triggers may be used for further CRT control (see Section 19).

The three display-control fields do not change when the unit configures itself in Automonitor mode.

11.1 DISPLAY MODE (Line 16)

When SINGLE is selected, DCE and DTE data are displayed alternately on the same line (see Figure 11-2). In DUAL display (Figure 11-3), DTE data begins on the first data line and DCE data is shown on the alternate lines. DCE data is always underlined in either display mode.

TECHNICAL NOTE: The relationship between Transmit and Receive data in dual-line display is accurate to within plus or minus 1 character.

11.2 SUPPRESSING DATA (Line 17)

You may enter in the DATA field up to eight characters to be suppressed from the CRT display (see Figure 11-1). Characters are suppressed from the CRT and the CRT buffer, giving you a highly condensed selective display. However, the suppressed characters will be received, considered by the triggers, and included in counting and timing. The SUPPRESS field may include:

- Upper- and lower-case alpha characters and numerals
- Control character mnemonics
- Hexadecimal entries
- The 7E (hex) Flag that frames bit-oriented protocols
- One Bit Mask
- All characters Not Equal to either a given character or Bit Mask.

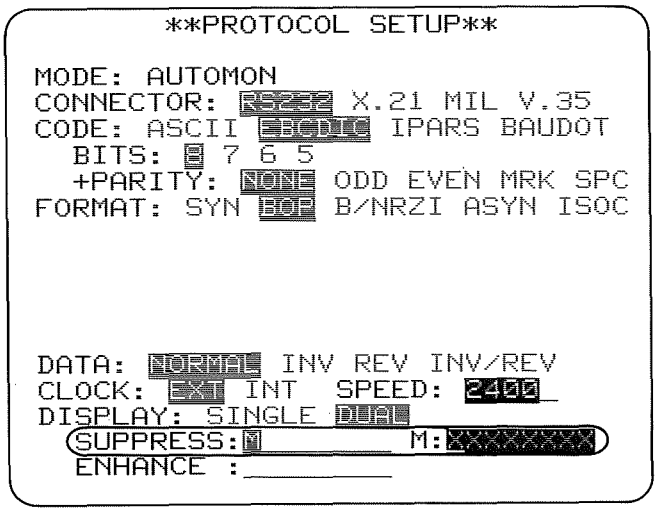


Figure 11-5 Display the bit mask by pressing the BIT MASK MSG key.

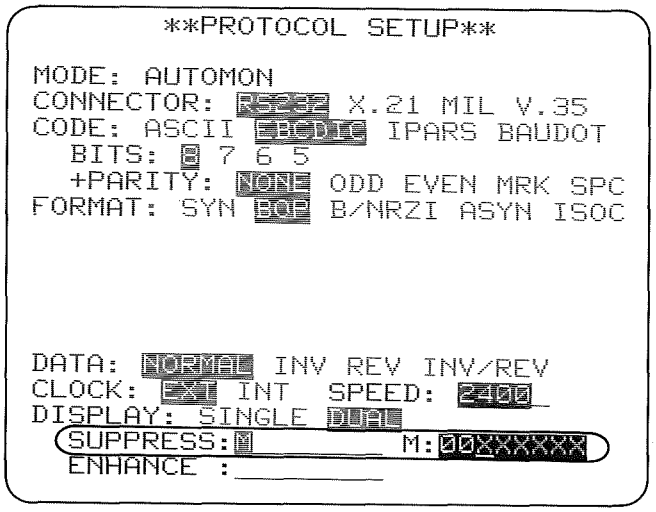


Figure 11-6 Bit mask set to suppress EBCDIC control characters.

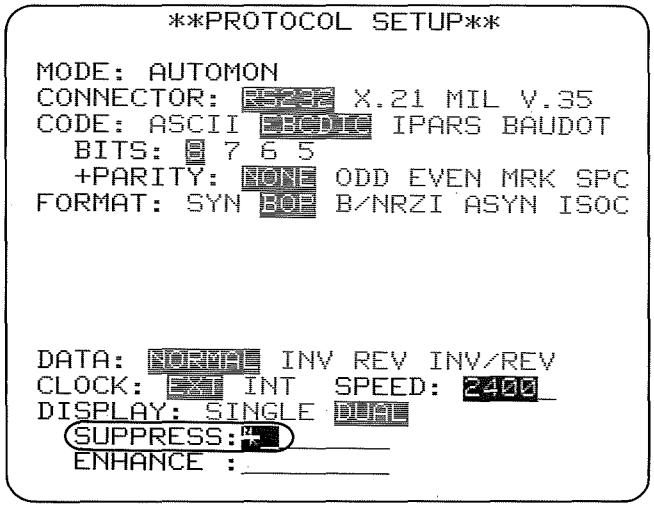


Figure 11-7 A bar through a character indicates "Not Equal."

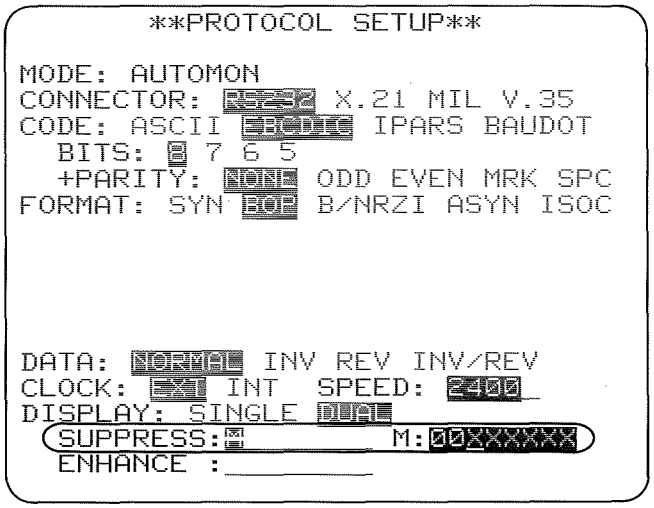


Figure 11-8 Suppressing everything except EBCDIC control characters.

(a) Flag Byte. To enter the 7E (hex) Flag used for framing bit-oriented protocols, press the FLAG FOX key. The Flag entry appears in low-intensity reverse image to distinguish it from a data 7E (hex) (see Figure 11-4). The logic will not read the key sequence HEX, 7, E as a Flag, but will assume it is a data character to which bit stuffing applies.

NOTE: A low-intensity character in a data-entry field always indicates that the character represents something other than itself. For example, the low-intensity 7E in Figure 11-4 represents a Flag Byte.

(b) Bit Mask. With the cursor on the SUPPRESS line, press the BIT MASK MSG key. This enters a low-intensity M at the cursor position. To the right of the data-entry line will appear M: followed by a special eight-place field (see Figure 11-5). The cursor automatically locates at the first place in the new field.

Each X in this field represents one bit of an 8-bit character, with the low-order, first serial bit on the right. An X means Don't Care; that is, the COMSTATE I will not check that bit. You may replace any of the X's with ones and (or) zeros. If, for instance, you enter 00 for Bits 8 and 7, the pattern will now be 00XX XXXX. All characters having 00 for Bits 8 and 7 will now be suppressed, as indicated by the low-intensity M in the list of suppressed characters (Figure 11-6). In EBCDIC all control characters have zeros for bits 7 and 8, so all control characters will now be suppressed from the display.

NOTE: Changing the code selection does not affect the number of bits displayed in the mask. If you have selected a code with less than eight information bits, say five, use the five lower-order (rightmost) bits and ignore the three excess higher-order bits.

NOTE: Selecting REV in the DATA field does not change the position of the low-order bit in the Bit Mask field. The COMSTATE I will automatically reverse the order of the bits that you enter. Also, 1 always means a logic 1 whether or not DATA:INV has been selected.

(c) Not Equal. You may suppress all characters not equal to any given character. For example, to suppress all characters but NAKs, press the NOT EQUAL key; then enter a NAK. Figure 11-7 shows NK displayed in the SUPPRESS list with a horizontal bar through it to indicate "not equal."

To suppress everything but characters that fit a certain bit mask, press NOT EQUAL, then BIT MASK. All characters that do not fit whatever pattern you then enter for the bit mask will be suppressed, and the low-intensity M in the SUPPRESS list will have a horizontal bar through it. For example, suppressing the Not Equal Bit Mask in Figure 11-8 would suppress all text characters; only EBCDIC control characters would be displayed.

11.3 ENHANCING DATA (Line 18)

Enhanced characters will be displayed in bright, reverse image. You may enter up to eight characters on the ENHANCE line. The valid characters are the same as for SUPPRESS.

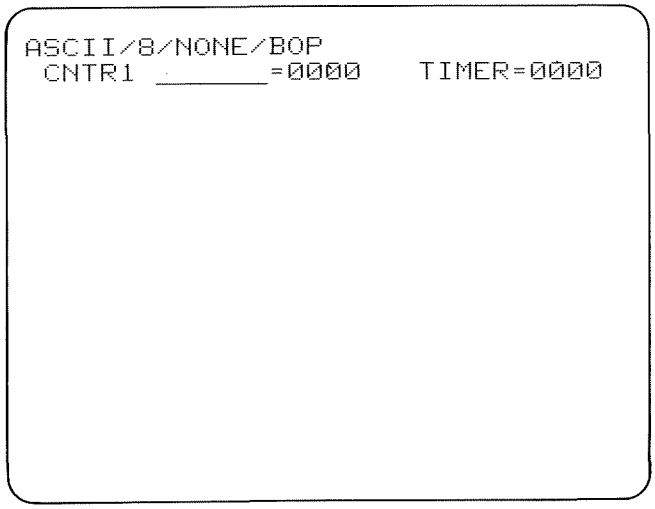


Figure 12-1 The data display ready to monitor X.25 data.

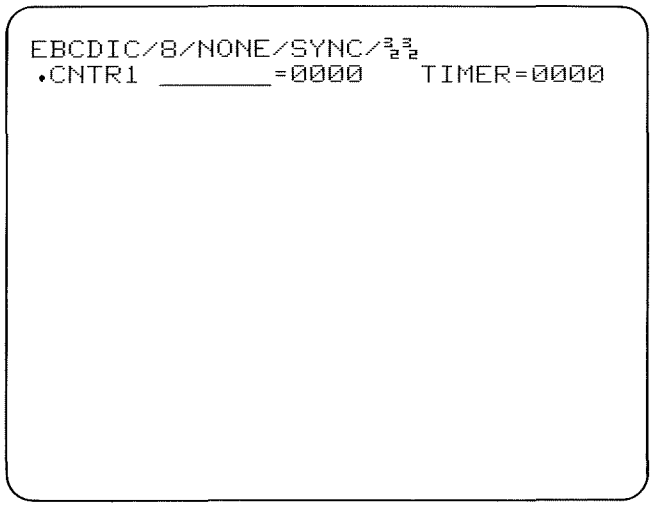


Figure 12-2 The data display ready to monitor EBCDIC BISYNC.

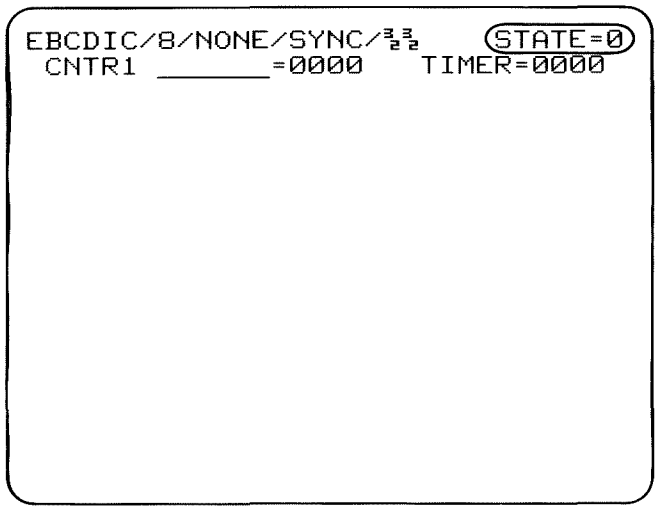


Figure 12-3 The current state is indicated in interactive tests.

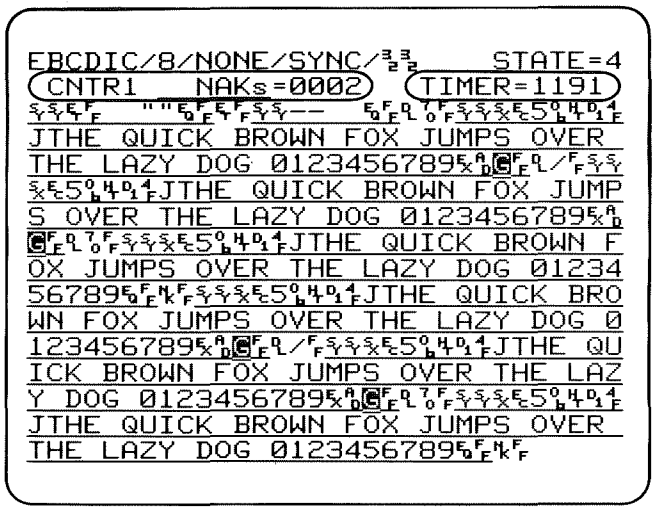


Figure 12-4 The counter and timer displays.

12
RUN MODE:
REAL-TIME DATA DISPLAY

The COMSTATE I's CRT can display two status lines and 512 data characters (in 16 32-character rows). Each 512-character display is called a "page." The CRT buffer capacity is 64 pages. This includes 32 kilobytes devoted to characters, and another 32 kilobytes devoted to the attributes of these characters.

12.1 STATUS LINE

Select MON in the MODE field on the Program 0 menu, and press the RUN key to see the real-time data display. This restarts the program and resets the CRT data buffer. A status line appears at the top of the screen, showing you the code and format for which the COMSTATE I is set up. Figure 12-1, for instance, shows you the COMSTATE I in X.25 operation expecting ASCII data, 8 information bits, no parity, in a bit-oriented protocol. Figure 12-2 shows a status line for EBCDIC BISYNC operation with 8 information bits, no parity, and synchronization pattern 32 32 (hex).

Figure 12-3 shows the status lines when the COMSTATE I is in a Test mode. The current Interactive Test state is displayed at the upper right.

12.2 COUNTER AND TIMER READINGS

On the second line is the real-time Counter 1 and Timer display (Figure 12-4). Counter 1 is one of four counters in the COMSTATE I that are assignable by the operator and controlled by triggers. The timer is also under trigger-control. The legend that appears alongside CNTR1 ("NAKs" in the example in Figure 12-4) is entered on the Program 2 screen. See Section 13, RUN MODE: STATISTICS.

The operator can reset the counters and the timer manually by pressing the RUN key. The RUN key also initializes the program and resets the CRT buffer.

12.3 DISPLAY FORMAT

Figure 12-4 shows a single-line data display. (Single- or dual-line display is selected on the Protocol Setup menu; see Section 11.1.) All DCE data is underlined because it comes from the communication line. The DTE data alternates with the DCE data.

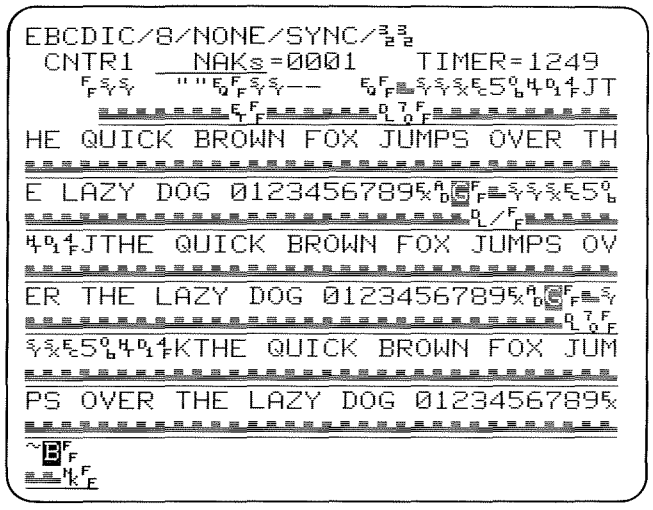


Figure 12-5 Dual-line data display.

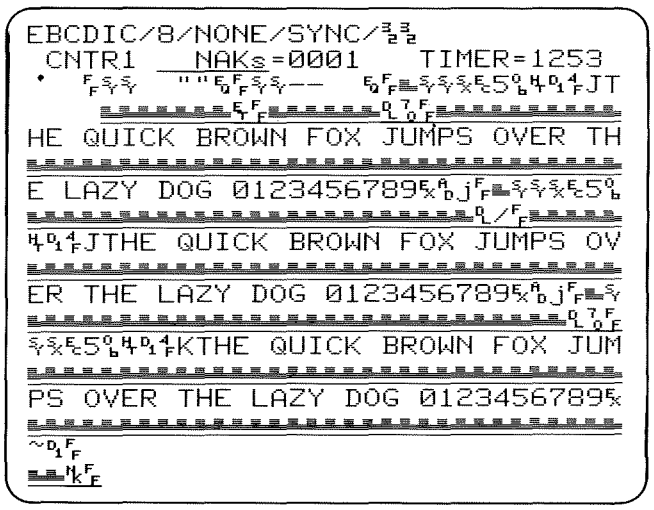


Figure 12-6 Data display with block checking disabled.

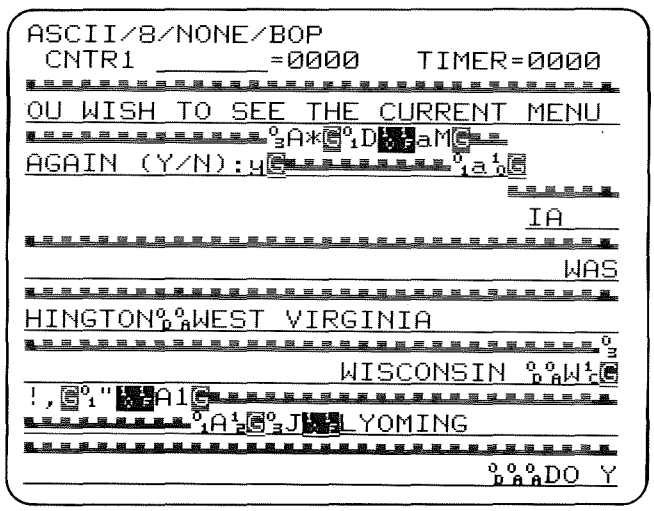


Figure 12-7 Enhanced LCNs in X.25 data.

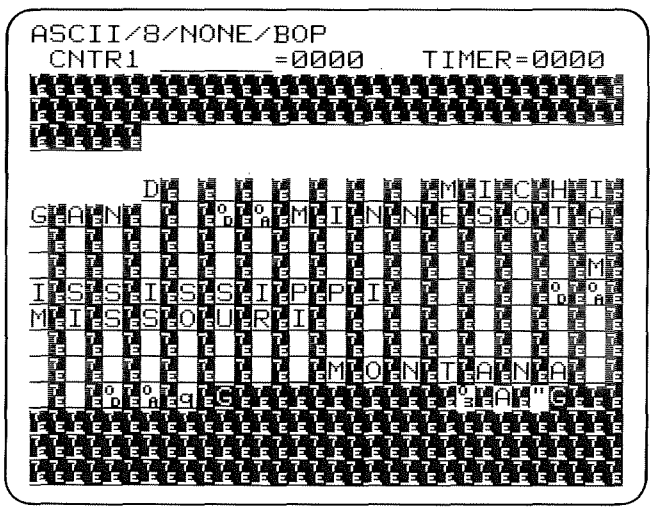


Figure 12-8 X.25 data shown with 7E Flags.

Figure 12-5 is a dual-line data display. The DTE data is shown on the first line; then the underlined DCE data on the next line. Time correlation is maintained by the "castles" or fill symbols. Use dual-line display to correlate TD and RD (or T and R in X.21) in a full-duplex system. Dual-line display does not use the CRT or buffer space as efficiently as single-line display, however. (For example, compare Figures 11-2 and 11-3.)

The COMSTATE STATUS LEDs tell you what operating mode the COMSTATE I is in and which data is being transmitted by the COMSTATE I. In TEST DTE mode the COMSTATE I is imitating a DCE, so the transmitted data will be underlined; in TEST DCE mode, the COMSTATE I will be receiving the underlined data.

12.4 BLOCK CHECK CHARACTERS

Notice in the figures that the last block check character is replaced with a low-intensity reverse-image G, for Good BCC, or a bright reverse-image B, for Bad BCC. An Abort is represented by a bright reverse-image A. Figure 12-6 shows data with RECEIVE BCC OFF. Both characters in each received block check sequence are shown because the COMSTATE I's block check logic has been turned off.

12.5 ENHANCEMENTS

The COMSTATE I enhances specific characters by showing them in bright reverse image. Triggers can be used to display strings of data in low intensity and (or) reverse image (see Section 19.3). In Figure 12-7, the LCNs in the DCE data are enhanced.

The 7E (hex) flags used in HDLC- or SDLC-framed protocols are always shown in low-intensity, reverse image (Figure 12-8). The flags may be suppressed from the display using the SUPPRESS selection on the Protocol Setup menu (see Figure 12-9).

When PARITY is selected on the Protocol Setup menu, all characters with parity errors are automatically displayed with bars through them. Pad characters and some block check characters will be shown with bars through them because there is no parity check on these characters when they are transmitted. (Some block check characters will coincidentally have the correct parity bit.)

In ASYNC format, characters with framing errors are displayed blinking, with a bar through them.

12.6 MANUAL CONTROLS

The entire CRT may be displayed in hexadecimal; or the hex display may be restricted to protocol-control characters only. To obtain the hexadecimal display, press the HEX key. The indicator on the front panel will light while the hexadecimal display is on. Press HEX again to turn it off. The hexadecimal protocol-character display is obtained with CONTROL-HEX.

Use the CLEAR key to clear all data from the screen. CLEAR will not clear the counter-timer display. The RUN key initializes the program and resets the CRT buffer, as well as resetting the counter and timer.

12.7 PROMPTS

In Figure 12-10, the status display on Line 1 is replaced by a message to the operator, or Prompt, which can be displayed by the trigger program (see Section 19.1). The prompt remains until it is replaced by another prompt or cleared by the RUN key.

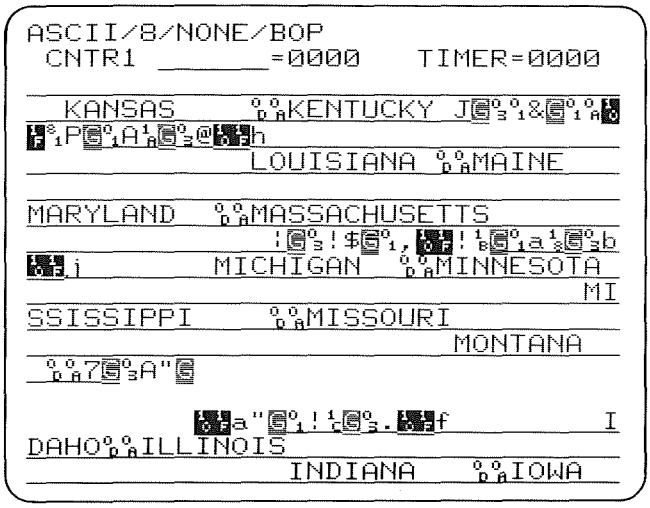


Figure 12-9 Same data as in Figure 12-8 but with 7E Flags suppressed.

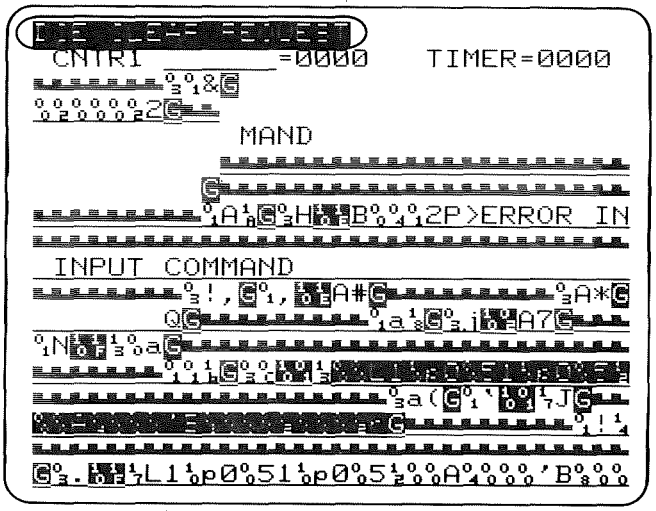


Figure 12-10 You can set prompts with triggers.

13 RUN MODE: STATISTICS

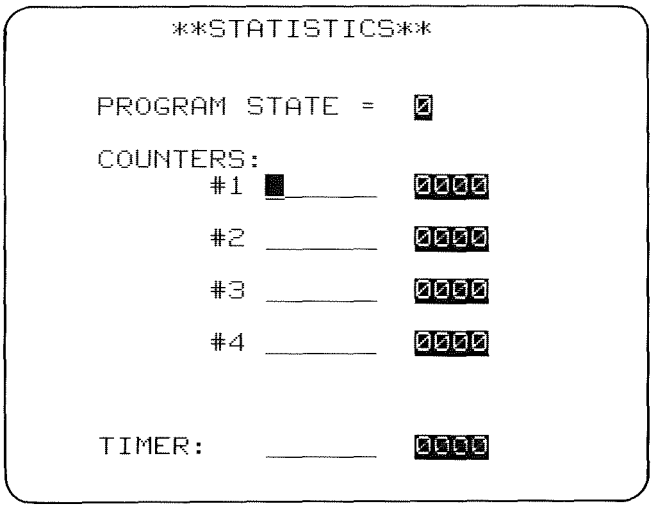


Figure 13-1

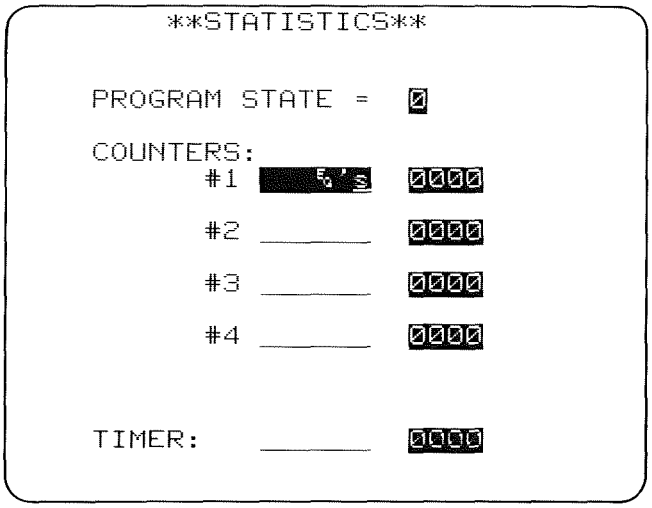


Figure 13-2

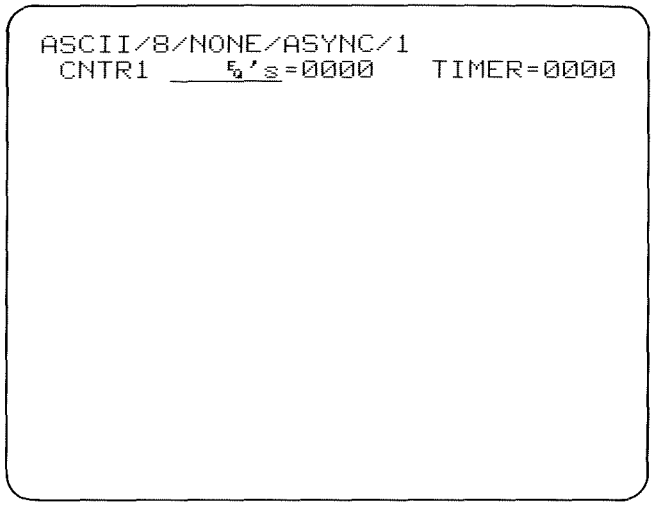


Figure 13-3

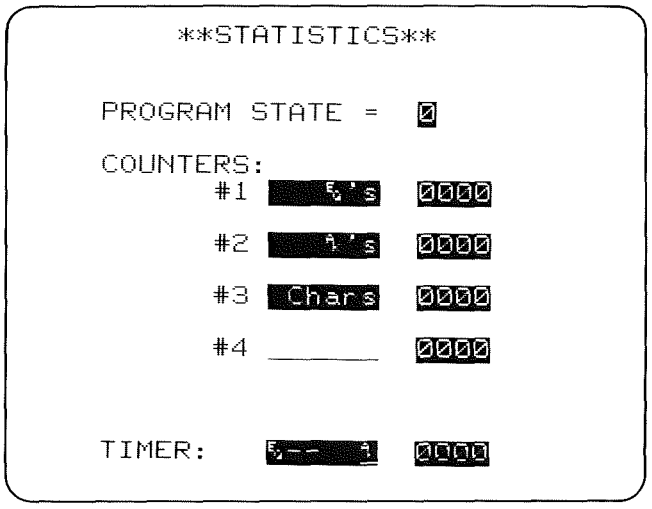


Figure 13-4

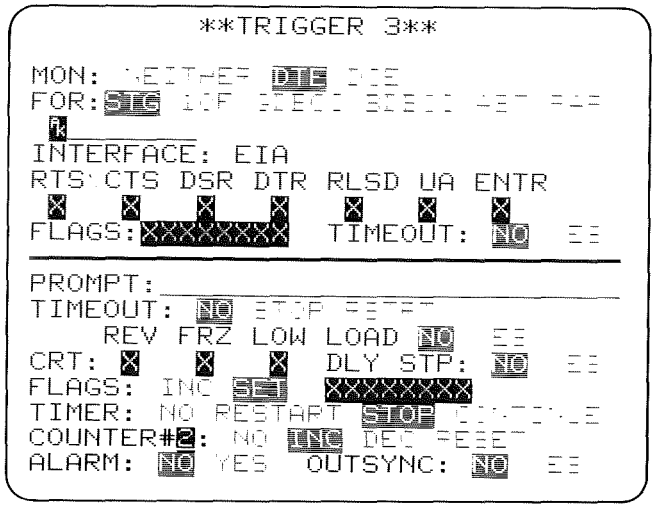


Figure 13-5

13
RUN MODE: STATISTICS

The COMSTATE I has a STATISTICS menu screen that keeps track of four counters and one timer, all under trigger control.

13.1 COUNTER AND TIMER LEGENDS

Press PROGRAM, 2, to call up the STATISTICS menu screen shown in Figure 13-1. The cursor is positioned to begin the legend for the first counter. The legend fields are ASCII-character fields, in which only alphanumeric keyboard characters or control character mnemonics (NULL or STX, for example) may be used. The legend in Figure 13-2 indicates that the operator will be using Counter 1 to count ENQ characters.

Along with its legend, Counter 1 (or another counter) is displayed in real time while the COMSTATE I is in Run mode. See Figure 13-3.

The ENTER key moves the cursor from legend field to legend field on the Statistics screen. The completed screen in Figure 13-4 is designed for a test of an asynchronous system where the applications program sends ENQs after a certain number of characters, and the terminal responds with ACKs. The test will determine the average number of characters that precede an ENQ, and the average time between ENQ and ACK.

13.2 TRIGGER CONTROL

Operator control of the counters and timer is discussed in Section 19, Selecting Trigger Actions. Figure 13-5 shows just one of the triggers in the test for ENQs and ACKs. This trigger increments Counter 2 and stops the timer whenever the DTE sends an ACK.

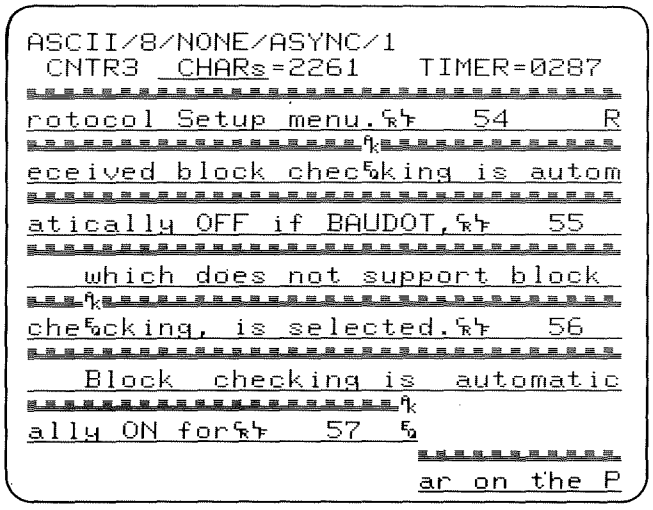


Figure 13-6

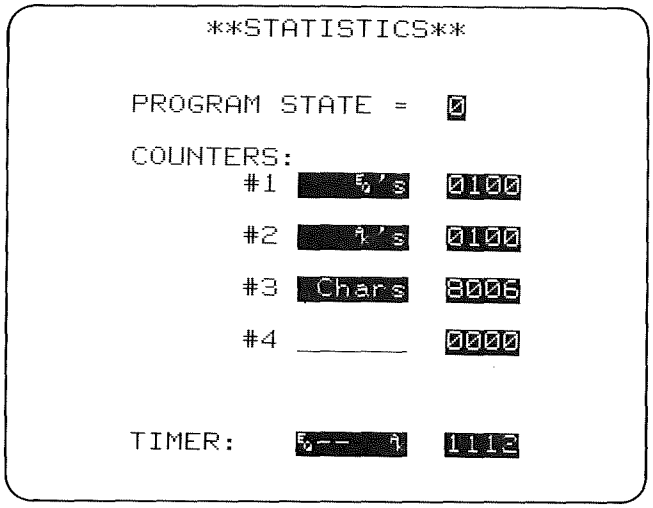


Figure 13-7

13.3 RESULTS

While a test is running, one counter at a time and the timer produce real-time readings on the Run-mode display screen. To read a counter other than Counter 1 in real time, simply press 2, 3, or 4 while the unit is in Run mode. See Figure 13-6.

To get a reading of all the counters at once, press the FREEZE key, then press "S." Figure 13-7 shows a statistical display while the unit is in Freeze mode. The counters indicate that the host sends an ENQ after every 80 characters; and the timer shows an average response time of approximately 11 milliseconds. (When the operator set Trigger 1 to restart the timer rather than continue it with every ENQ, he discovered by watching the real-time display that the response times varied widely from 5 to 15 milliseconds.)

While the unit is in Freeze mode, trigger activity (and thus trigger control of the counters and timer) is suspended. Special keys B, E, F, P, R, T, 1, 2, and 3 are active along with S. See Sections 14 and 15 for the functions of these keys. Press FREEZE a second time to return to Run mode and to trigger activity. This will not initialize (reset to 0) the counters and timer.

The PROGRAM, 2, key sequence will also call up the Statistics screen. The test values will be preserved until the next time Run mode is entered, when the counters and timer will reset to zero.

The PROGRAM STATE field on the Statistics screen indicates the state that the program had attained when Run mode was exited. See Section 22 for an explanation of states in an interactive test.

TABLE 14-1
VIEWING THE DATA BUFFER

Activity	Trigger Freeze	Delay Stop	Manual Freeze	Data Buffer
To turn on	On Trigger, enter 1 for CRT FRZ.	On Trigger, select DLY STP:YES.	Press FREEZE key.	Press PROGRAM followed by F key.
To turn off	On Trigger, enter 0 for CRT FRZ.	Cannot be turned off by trigger. Press PROGRAM, RUN, or FREEZE key.	Press FREEZE key again, or RUN key.	--
Freeze indicator on front panel	Off	On when 256 more characters have been received.	On	On
Scrolling	Cannot scroll; only one page can be viewed.	Entire 64-page data buffer may be viewed.	Entire 64-page data buffer may be viewed.	Entire 64-page data buffer may be viewed.
Status line	Yes	Yes	Yes	Yes
Counter and timer operation	Continue to operate; readings displayed on Line 2	Stop; readings not displayed.	Stop; readings not displayed.	Stop; readings not displayed.
Binary cursor character expansion on Line 2	No	Yes	Yes	Yes

14
RUN MODE:
THE CRT DATA BUFFER

You can control the flow of data into the data buffer, and review the contents of the buffer, using the following four features of the COMSTATE I:

- Trigger Freeze;
- Trigger Delay Stop;
- Manual Freeze;
- Data Buffer Display (Program F).

These four features are described below, and summarized in Table 14-1. Instructions for controlling the two trigger features are in Section 19.4.

You also may devise new test programs to run against data already in the data buffer. See Section 15, Reanalysis.

14.1 THE CURSOR: SCROLLING

In all of these "frozen" display modes except Trigger Freeze, you may scroll through the COMSTATE I's 64-page CRT data buffer using the UP and DOWN cursor arrows. When you enter any of the modes, the cursor is positioned on the last byte of data received, with two blank lines below the cursor. These blank lines precede the new data all during Run mode, and separate new data

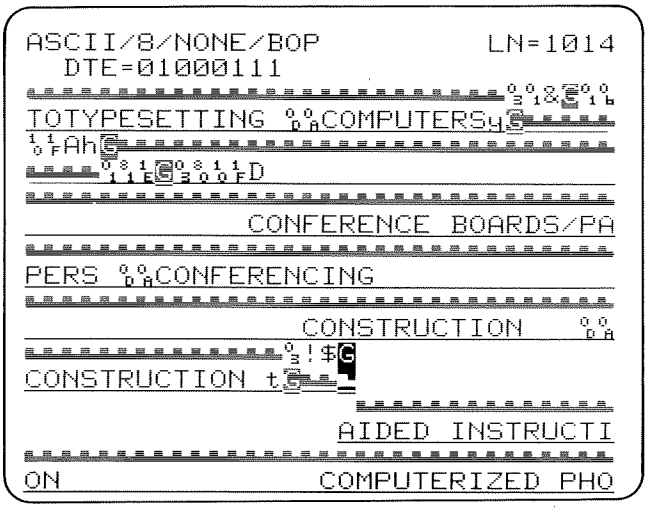


Figure 14-1 Data display in freeze.

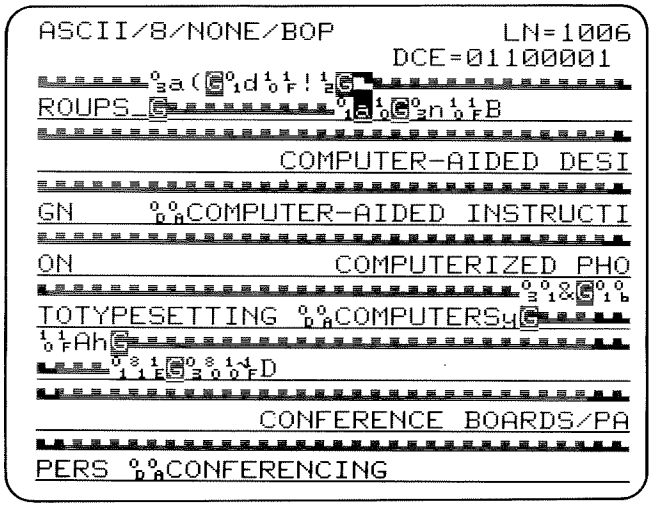


Figure 14-2 Move the cursor to scroll through the buffer.

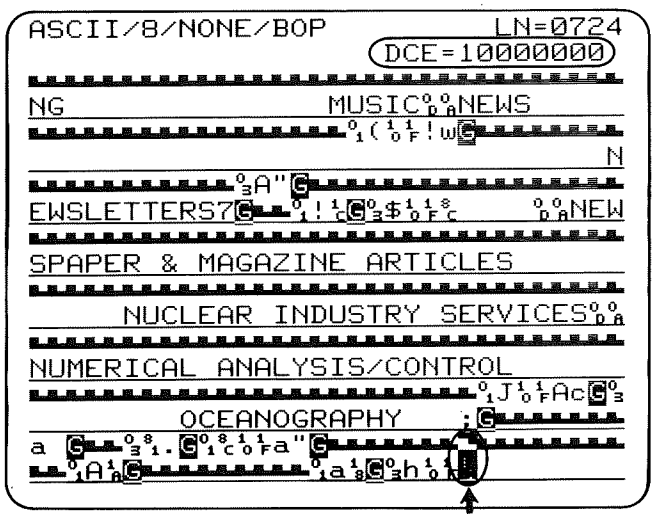


Figure 14-3 In freeze, the character at the cursor location is expanded in binary form.

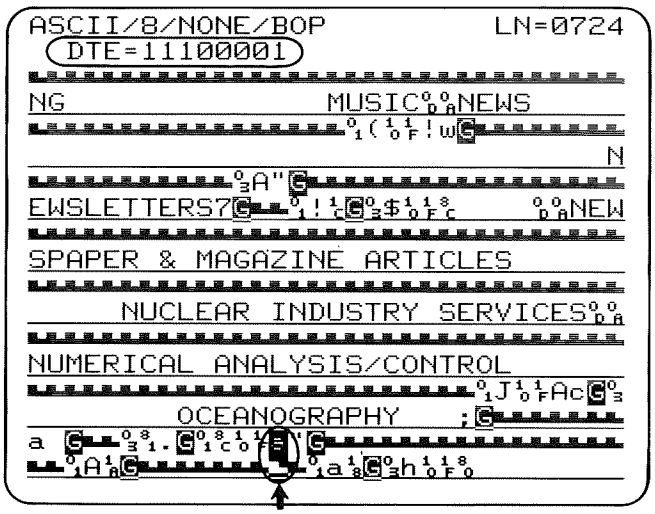


Figure 14-4

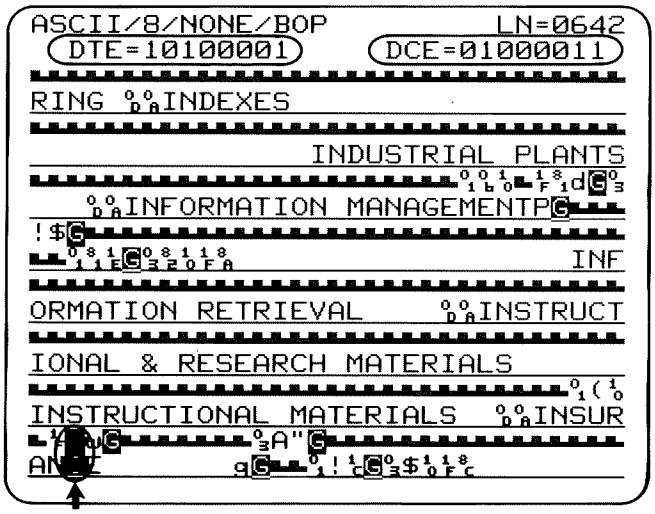


Figure 14-5

from data that is to be overwritten.

Use the UP arrow to scroll back through the buffer.

When the cursor reaches the top or bottom of the CRT, each depression of the UP or DOWN arrow pulls another line of data from the buffer onto the screen. You can see the entire adjoining page of the buffer by pressing CONTROL-UP (or DOWN). SHIFT-UP (or DOWN) will also display the adjoining page of the buffer.

Press the "B" key to go to the beginning of the buffer; press "E" to go to the end of the buffer.

At the upper right of the display is the buffer line number of the first line of data on the display. (See Figure 14-2.) LN=000 is the first line in the buffer. LN=1024 is the last possible line of the buffer.

You may also move the cursor right or left with the RIGHT or LEFT cursor arrow. For any cursor movement, holding down a key causes a repeat.

14.2 HEXADECIMAL DISPLAY

The HEX key and SHIFT-HEX or CONTROL-HEX work the same way as on the real-time display (see Section 12.6). You may show all data in clear text or in hexadecimal, or only control characters in hexadecimal.

14.3 BINARY CHARACTER DISPLAY

An eight-digit binary number appears on Line 2 of the Data Buffer display (see Figures 14-3 and 14-4). This is the binary value of the character at the cursor position. Since you can scroll the cursor through the display buffer at will, you can see this binary expansion for any character in the buffer. Notice that the DTE expansion is always on the left of Line 2, and the DCE expansion on the right. In DUAL-line display, two characters are expanded when the cursor is over both characters (see Figure 14-5).

For normal data, the low-order (rightmost) digit, Bit 1, is the first bit received; the high-order (leftmost) digit, Bit 8, the last bit received. (If DATA:REV has been selected on the Protocol Setup menu, this order is reversed.) This is an important point, especially with regard to bit-oriented protocols, because the order in which the bits are numbered and printed in the literature varies.

14.4 TRIGGER FREEZE

The display may be frozen under trigger control. Select CRT:FRZ 1 as a trigger action. When the display is frozen by triggers, the FREEZE LED remains off. The receivers are still in synchronization, and the trigger program and Interactive Test continue. The State indicator (line 1) remains on the

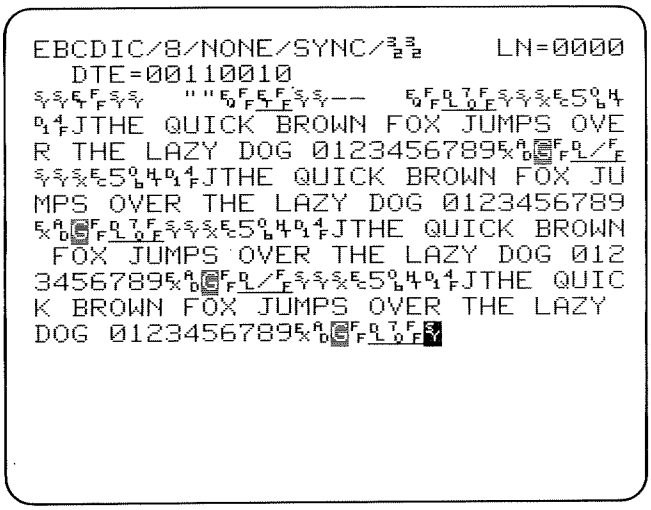


Figure 14-6 Delayed stop triggered by "FOX."

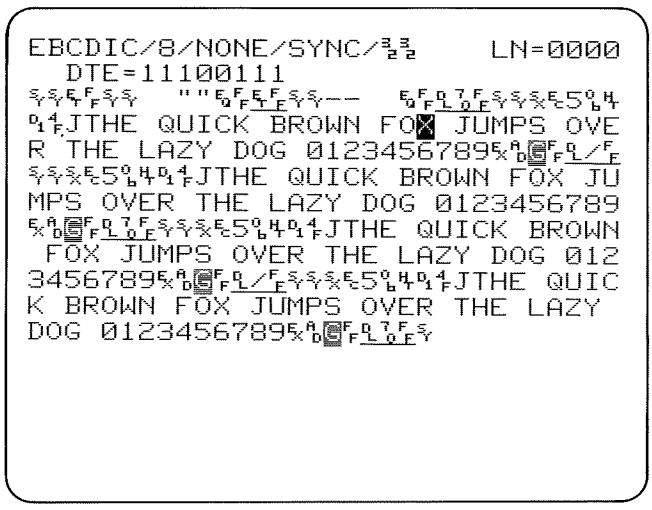


Figure 14-7 Scroll back 8 lines to confirm which "FOX" triggered the delayed stop.

screen. Data is being received even though it is not being added to the CRT buffer. Data can still be counted and timed, and the real-time values can still be read on Line 2. Line 1 continues to show the status of the Interactive Test.

You may view one screen of data, but you cannot scroll through the buffer in Trigger Freeze. Special Freeze-mode display keys (B, E, F, P, R, T, S, 1, 2, and 3) are not legal.

Trigger Freeze usually should be turned off by a trigger. You can cancel it with the RUN key, but this initializes the program and also resets the data buffer. Alternatively, you can override Trigger Freeze with Manual Freeze, then manually unfreeze the display to continue the test.

14.5 TRIGGER DELAY STOP

Delay Stop freezes the data display 256 characters after the trigger conditions come true. All program activity and data reception stop, so counters and timers stop. On line 1, State information is shown just as during the real-time data display, and the buffer line number is added at the right. The binary expansion of the cursor character, or characters, is displayed on line 2.

In Delay Stop, you may scroll through all 64 pages of the CRT buffer. Once 256 characters have been received and program activity ceases, Delay Stop is in all respects similar to Manual Freeze, described in Section 14.6.

In single-line display mode, you can easily find the character that arrived at the time the causing trigger came true, eight lines or 256 characters previously. Do not move the cursor right or left when the data flow stops; just scroll upward eight lines, and the cursor will be on the trigger character. Figure 14-6 shows a Delay Stop display triggered by the DCE string FOX. Scrolling back eight lines (Figure 14-7) positions the cursor on the last character of that string. There is no confusion about which FOX string caused the trigger.

Data flow cannot be restarted by a trigger action, so to get out of the Delay Stop mode, press the FREEZE, RUN, or PROGRAM key. (FREEZE has the effect of a manual unfreeze: see next section.)

14.6 MANUAL FREEZE

Freeze the display manually by pressing the FREEZE key. The Freeze indicator on the front panel goes on, and addition of data to the CRT buffer stops. The frozen display looks exactly like that for Delay Stop, and you can scroll through the buffer in the same fashion. Trigger activity stops, therefore the counters and timer stop.

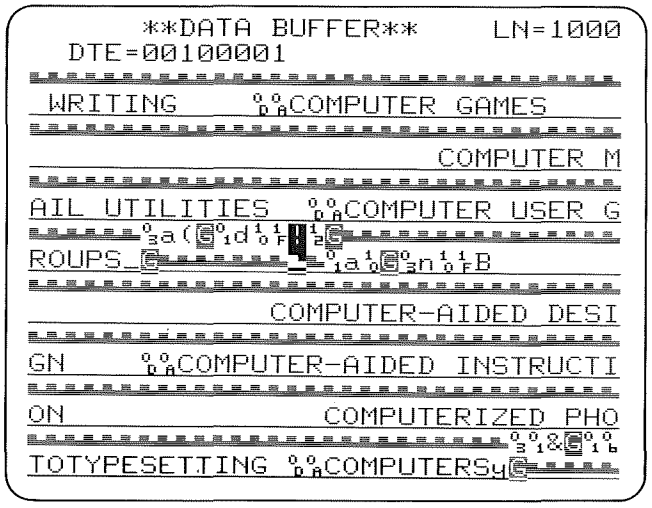


Figure 14-8 The Data Buffer (PROGRAM F).

In Manual Freeze, as in Delay Stop, you may restore the data flow by pressing the FREEZE key again. The Freeze indicator will go off, the program will be initialized, and trigger control will begin. Invoking Manual "Unfreeze" differs from entering Run mode, however, in an important respect: pressing the FREEZE key to unfreeze the CRT and the program activity does not reset the data buffer, the counters, or the timer.

14.7 DATA BUFFER DISPLAY (PROGRAM MODE)

If you press the PROGRAM key while the COMSTATE I is in Run mode, the receivers go out of synchronization and no more data is added to the CRT buffer. The last 64 pages of data remain in the buffer, however, until you press the RUN key. If you want to see this data, press PROGRAM, then the F key.

Line 1 identifies the display as the DATA BUFFER and the buffer line number is at the right (see Figure 14-8). On Line 2 appears the binary expansion of the cursor character, just as in Freeze and Delay Stop modes. You may scroll through the entire 64-page buffer, and use the cursor to select any character on the screen for binary expansion. Using the PROGRAM key to return to Program mode does not reset the buffer. When you next press the RUN key, the buffer will be reset.

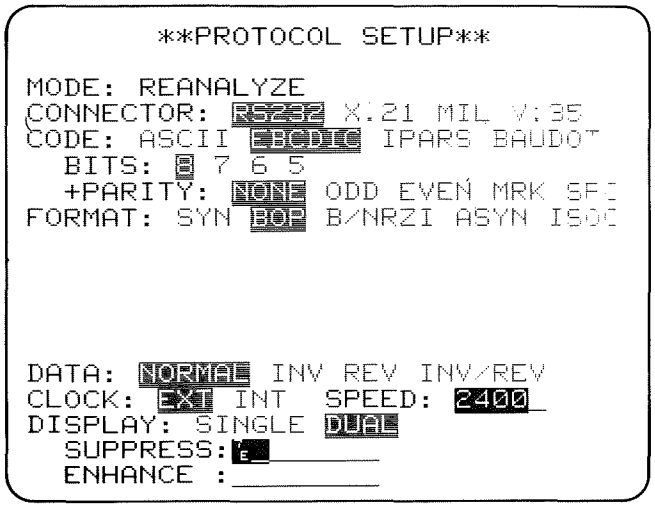


Figure 15-1

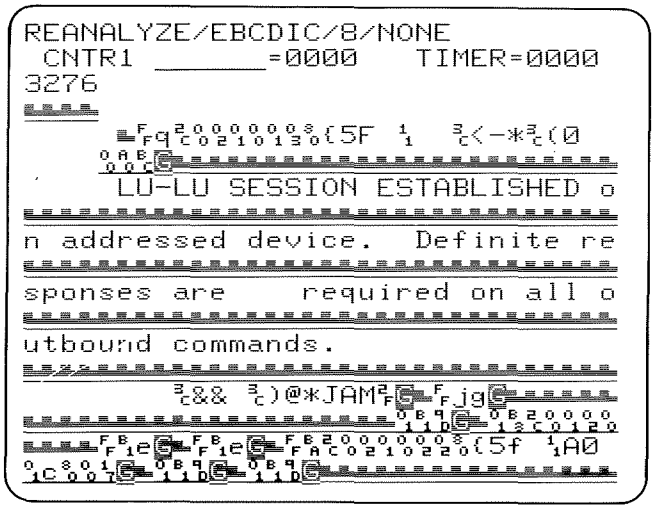


Figure 15-2

15
RUN MODE: REANALYZE

The entire 64-kilobyte data buffer from beginning to end can be routed to simulated (software) receivers that reanalyze the data as though it were data viewed on the line for the first time. The eight triggers are enabled, and a test or a series of tests can be run against the captured data.

15.1 REANALYZE MODE

After you press the PROGRAM key to call an end to a monitor test or an interactive test, the data buffer does not empty until the next time RUN is depressed. To view the contents of the data buffer running sequentially as though it were live data, go to the Protocol Setup menu screen (press PROGRAM, 0) and ROLL the MODE window until REANALYZE is selected. See Figure 15-1.

Press RUN. The data buffer empties its contents one byte at a time into simulated receivers that display the data on the screen and then return it to the data buffer for the next reanalysis. See Figure 15-2.

15.2 REANALYZE DATA VS. LINE DATA

Captured data is similar to line data in that it is displayed sequentially. Also it can activate enhancements and counters and other trigger-menu actions, and thus drive test programs. Data in this form differs from line data in several important respects, however.

- Real-time intervals between bytes are not maintained. The data buffer channels its contents to the Reanalyze-mode receivers one byte at a time in a steady stream. Press UP or DOWN arrow to alter the speed of this data stream; or change the clock-speed selection on the Program 0 menu.

- EIA leads are not captured; so EIA-lead trigger conditions cannot be used.

- Suppressed data is not preserved. Characters that are not displayed are lost. If you are using standard BISYNC and you select IDLE DISPLAY: OFF on the Protocol Setup screen, the idle pad-characters are not stored in the data buffer. If you are working

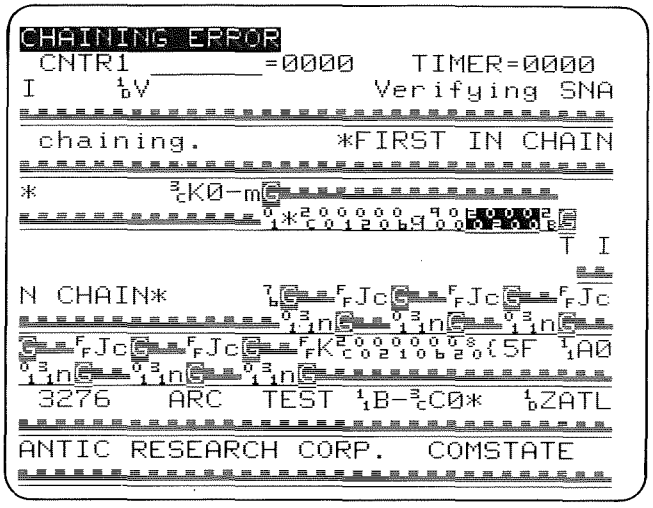


Figure 15-3

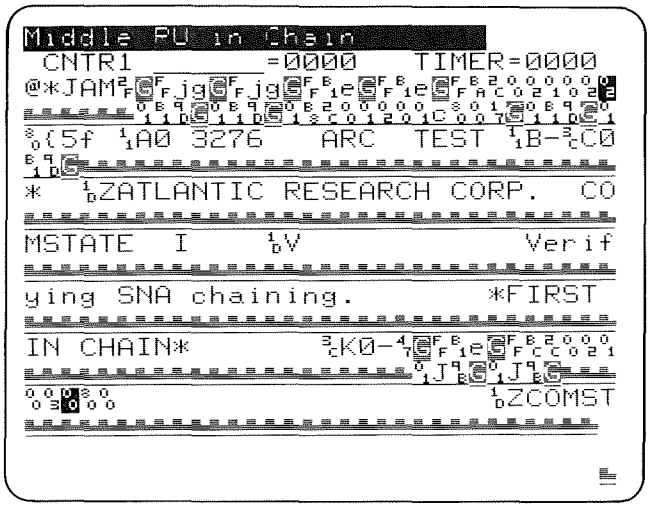


Figure 15-4

in a bit-oriented protocol and choose to suppress 7E flags (SUPPRESS field, PROGRAM 0), these flags will not be captured and they will not be available for triggering. (Many string-search conditions in BOP begin "7E flag, not-equal 7E flag," etc.) If you suppress flags during the first playback in Reanalyze mode, the flags will be lost for the next playback.

- Enhancements that were activated by triggers or by the ENHANCE field (Program 0) during data capture or during the previous reanalysis are stripped off by the Reanalyze-mode receivers. In this respect, data in Reanalyze mode has a different appearance from captured data that you access by pressing PROGRAM, F. This stripping allows you to change enhancements and in general to start with fresh data every time you press the RUN key. (Automatic enhancements, such as 7E flags and various X.21 idle characters, are not stripped. Full-intensity reverse-video A's and B's and low-intensity reverse G's, which normally designate aborts and BCCs but which may in some cases be your own enhancements, are not stripped.)

- Reanalyze-mode receivers read bytes, not bits. They are always in sync. This means that when synchronous data is reanalyzed, all sync characters in the data buffer are displayed, and none are depleted. OUTSYNC and AUTO SYNC menu fields are not applicable.

15.3 APPLICATIONS

Figures 15-3 and 15-4 demonstrate a typical use of the Reanalyze mode. In Figure 15-3, the unit is in Monitor mode, attached to an SNA data-line, when the triggers detect a sense code that indicates a chaining error. In Figure 15-4, the operator is reanalyzing the data that preceded the chaining error. A new program has been entered. The Request-Header byte that contains the chaining-indicator bits is enhanced; and prompts appear at the top of the display to trace the chaining sequence.

PROGRAMMING NOTE: If 7E flags are suppressed in programs designed for bit-oriented protocols, they are left out of the data buffer and therefore not available for triggering. Here is a technique for finding the start of a frame when there are no 7E flags. (The technique also works when 7E flags are present.) In this example, the test enhances the ninth bit in a DTE frame.

Trigger 1: Monitor DTE for GDBCC; set internal flags to 00000000.

Trigger 2: Monitor DTE for 10F NOT EQUAL 7E-FLAG; increment flags.

Trigger 3: Monitor DTE for 10F DON'T CARE, monitor internal flags for 00001000; set CRT REV 1.

Trigger 4: Monitor DTE for 10F DON'T CARE, monitor flags for 00001001; set CRT REV 0.

Another typical use of the Reanalyze mode is to slow down high-speed data. The COMSTATE I is rated for data capture and real-time display at 64 kilobits per second, and for two trigger groups (per state) at 48 kbps. But a complex program with eight simultaneous triggers may not run at those high speeds. With this special test mode, the operator can capture 64 pages of high-speed data, load a complex program, and reanalyze.

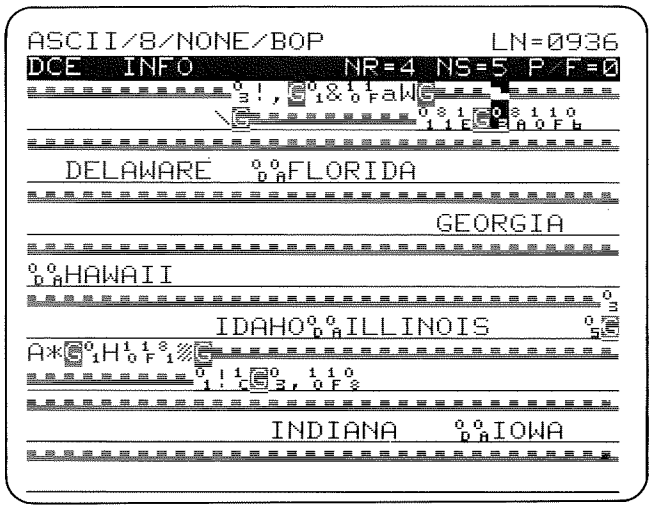


Figure 16-1 COMSTATE I can display data with frame- or packet-level expansion.

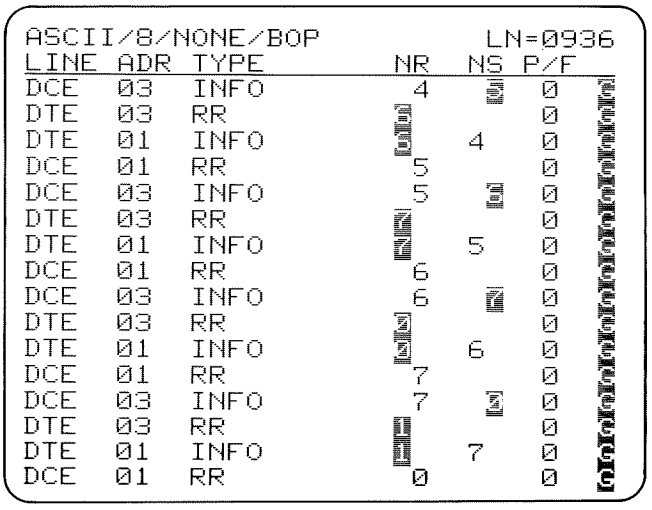


Figure 16-2 COMSTATE I can also display expansions only.

16
FRAME AND PACKET EXPANSION IN BIT-ORIENTED PROTOCOLS (X.25)

16.1 INTRODUCTION

The COMSTATE I's X.25 Protocol Trace Display is an aid to analyzing HDLC and SDLC data. It can display frame protocol mnemonic expansions for HDLC protocols, either LAP or LAP B, and SDLC. For HDLC, MOD 8 and MOD 128, it can also display packet protocol. Frames with extended addressing cannot be correctly analyzed.

The X.25 Trace Display has two functions:

(1) While data is displayed, it will automatically find the next frame on the CRT screen and display a mnemonic expansion of the frame- or packet-level protocol for that frame. Figure 16-1 shows an example.

(2) It can replace the data display with a sequential display of frame or packet protocol mnemonic expansions, as in Figure 16-2.

Table 16-1 is the frame-control mnemonic set used by the COMSTATE I. Table 16-2 shows the packet-type mnemonic set used for modulo 8, and Table 16-3 shows the set used for modulo 128.

16.2 AUTOMATIC FRAME AND PACKET ANALYSIS

For the frame or packet logic to work properly, data should not be suppressed from the display or enhanced (by means of either the Protocol Setup menu or Trigger menus). The logic analyzes the data actually in the buffer, rather than the data stream as it is received from the line. For protocol bytes to be correctly identified, all protocol must be in the buffer.

NOTE: It is all right to suppress flags (7E, hex) from the display by using the FLAG FOX key in the SUPPRESS field on the Protocol Setup menu.

TABLE 16-1
FRAME-CONTROL MNEMONICS

Bit Pattern	SDLC or SDLC NRZI		7E/X.25 or BSC/X.25	
8 7 6 5 4 3 2 1	Mnemonic	Definition	Mnemonic	Definition
INFORMATION TRANSFER FORMAT				
N(R) P N(S) 0	INFO	INFOrmation	INFO	INFOrmation
SUPERVISORY FORMAT				
N(R) P/F 0 0 0 1	RR	Receiver Ready	RR	Receiver Ready
N(R) P/F 0 1 0 1	RNR	Receiver Not Ready	RNR	Receiver Not Ready
N(R) P/F 1 0 0 1	REJ	REJect	REJ	REJect
N(R) P/F 1 1 0 1	---	---	SREJ	Selective REJect
UNNUMBERED FORMAT				
0 0 0 P/F 0 0 1 1	UI	Unnumbered Information	---	---
0 0 0 P/F 0 1 1 1	SIM/RIM	Set Initialization Mode/Request Initialization	---	---
0 0 0 F 1 1 1 1	ROL/DM	Request On Line/ Disconnect Mode	DM/SARM	Disconnect Mode/ Set Asynchronous Response Mode
0 0 1 P/F 0 0 1 1	UP	Unnumbered Poll	---	---
0 0 1 P 1 1 1 1	---	---	SABM	Set Asynchronous Balance Mode
0 1 0 P/F 0 0 1 1	DISC/RD	DISConnect/Request Disconnect	DISC	DISConnect

(continued)

TABLE 16-1 (continued)

Bit Pattern	SDLC or SDLC NRZI		7E/X.25 OR BSC/X.25	
8 7 6 5 4 3 2 1	Mnemonic	Definition	Mnemonic	Definition
UNNUMBERED FORMAT				
0 1 1 F 0 0 1 1	UA	Unnumbered Acknowledgment	UA	Unnumbered Acknowledge
1 0 0 F 0 1 1 1	FRMR	FRaMe Reject	FRMR	FRaMe Reject
1 0 0 F 0 0 1 1	SNRM	Set Normal Response Mode	---	---
1 0 1 P/F 1 1 1 1	XID	eXchange station ID	---	---
1 1 0 P/F 0 1 1 1	CFGR	ConFIGuRe	---	---
1 1 1 P/F 0 0 1 1	TEST	link TEST	---	---
1 1 1 F 1 1 1 1	BCN	BeaCoN	---	---
All other patterns		UNKNOWN		UNKNOWN

TABLE 16-2
PACKET-TYPE MNEMONICS (MOD 8)

Octet 3 8 7 6 5 4 3 2 1	Display XX = Hex 00-FF	Mnemonic	Definition
0 0 0 0 1 0 1 1	0B	CALL	CALL
0 0 0 0 1 1 1 1	0F	CALL ACC	CALL ACCept
0 0 0 1 0 0 1 1	13	CLEAR	CLEAR
0 0 0 1 0 1 1 1	17	CLEAR C	CLEAR Confirm
P(R) M P(S) 0	XX	DATA	DATA
1 1 1 1 0 0 0 1	F1	DIAG	DIAGnostic
0 0 1 0 0 0 1 1	23	INT	INTerrupt
0 0 1 0 0 1 1 1	27 or "'"	INT CONF	INTerrupt CONFirm
P(R) 0 0 0 0 1	X1	RR	Receiver Ready
P(R) 0 0 1 0 1	X5	RNR	Receiver Not Ready
P(R) 0 1 0 0 1	X9	REJ	REJect
0 0 0 1 1 0 1 1	1B	RESET	RESET
0 0 0 1 1 1 1 1	1F	RESET C	RESET Confirm
1 1 1 1 1 0 1 1	FB	RSTRT	ReSTaRT
1 1 1 1 1 1 1 1	FF or "pad"	RSTRT C	ReSTaRT Confirm
P(R) 0 1 1 0 1	XD	SREJ	Selective REJect
All other		UNKNOWN	

TABLE 16-3
PACKET-TYPE MNEMONICS (MOD 128)

Octet 3								Octet 4								Mnemonic	Definition
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1		
P(S)							0	P(R)							M	DATA	DATA
0	0	0	0	0	0	0	1	P(R)							0	RR	Receiver Ready
0	0	0	0	0	1	0	1	P(R)							0	RNR	Receiver Not Ready
0	0	0	0	1	0	0	1	P(R)							0	REJ	REJect
0	0	0	0	1	1	0	1	P(R)							0	SREJ	Selective REJect

All other packet types are the same as for MOD 8.

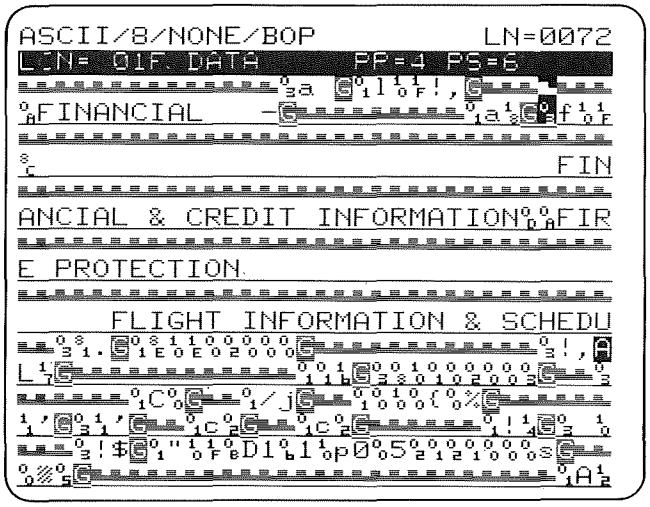


Figure 16-3 Packet-type expansion display.

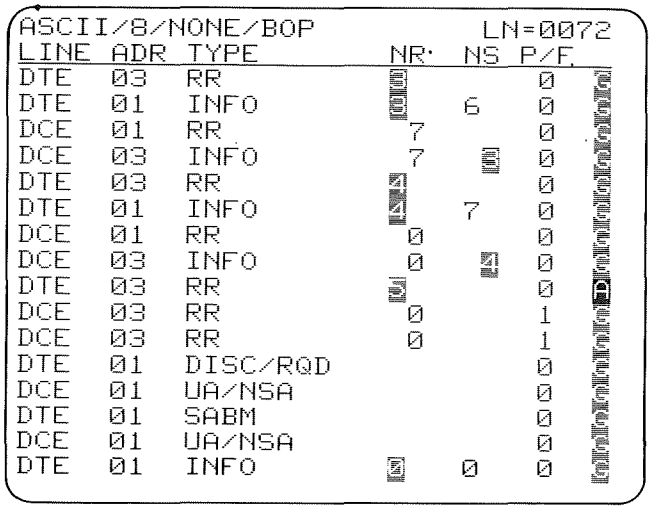


Figure 16-4 Frame-level protocol trace display.

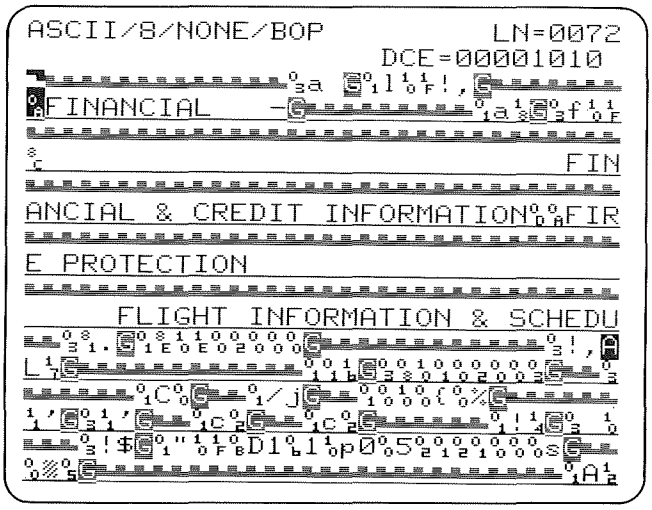


Figure 16-5 Status line (line 1) stays the same.

Freeze the data display and move the cursor back to the desired location in the buffer, using either the "B" key or the cursor control keys. To locate the next frame, press the "F" key.

The cursor automatically moves to the first byte in the next frame on the screen. Figure 16-1 is a typical display, showing the origin of the frame (DTE or DCE), the frame type, NR and NS values, and P/F bit status. Notice that although there is a dual-line cursor on the display, you can tell from the information on line 2 whether the logic is expanding the DTE or the DCE byte.

To locate the first packet (starting from the cursor position), press the "P" key. If there is a packet in the frame where the cursor is located, the cursor will not move. Figure 16-3 is an example of the packet-type expansion display. It shows the logical channel number, packet type, and PR and PS counts when applicable.

16.3 MANUAL FRAME AND PACKET ANALYSIS

You may position the cursor manually on the first byte (address byte) of any frame in the buffer and obtain a frame or packet protocol expansion of it.

To see a frame expansion, position the cursor on the frame-address byte (the first non-flag byte in the frame) and press SHIFT-F. To see a packet analysis, go to the same frame-address byte and press SHIFT-P. The logic will assume the cursor has been correctly positioned; it will display a nonsense expansion if you have missed the frame-address byte.

If the display is dual-line, you may choose which lead you want the frame or packet logic to analyze. Press the "T" key to select TD (or T in X.21); then go to the frame-address byte and press SHIFT-F or SHIFT-P to analyze the frame or packet. Press "R" to select RD (or R in X.21), before pressing SHIFT-F or SHIFT-P. Either lead selection will remain in effect until you cancel it by selecting the other.

16.4 PROTOCOL TRACE DISPLAY

Freeze the data display. To see a trace display of the frame (level 2) protocol expansions from both DTE and DCE, press the "2" key. Figure 16-4 shows the display. Notice that the status information and the buffer line number on line 1 remain the same as in the data display. (Compare Figure 16-4 with Figure 16-5.)

The first column (headed LINE) shows the origin of the frame, DTE or DCE. The second column (ADR) gives the hexadecimal value of the address byte. Next is the mnemonic for the frame TYPE. Then in the NR and NS columns, the DTE and DCE values are staggered, with the DTE value always to the left. Highlighting is used so that the eye can follow the two separate NR-NS sequences: DTE expects to receive 3 (highlighted), DCE sends 3 (highlighted); DTE expects to receive 4, DCE sends 4. Meanwhile DCE expects to receive 7, DTE sends 7; and so on. P/F status and received block check are given for each frame.

You may scroll through the entire 64-page buffer in the same way as for the data display, using UP or DOWN, CONTROL with UP or DOWN, and "B" or "E." To see the data display for the current buffer page, press the "1" key. The status line will remain the same and the data will replace the trace display.

To see a trace display of packet (level 3) information for the current buffer page, press the "3" key. Figure 16-6 is a packet trace at the same buffer location displayed in Figures 16-4 and 16-5. The general format is nearly the same as for the frame sequence, but LCN (logical channel number) replaces the address column. PR and PS columns are set up in the same way as the NR and NS columns. Q, D, or M is displayed if the appropriate bit is set.

In Figure 16-6, the cause code for the Clear Indication packet is displayed. 03 (hex) means "invalid facility request." 42 (hex), the diagnostic code, means "facility parameter not allowed."

Press the "4" key for a display combining the frame and packet traces. See Figure 16-7. In this display, supervisory and unnumbered frames are expanded as frames, while info frames are given packet expansion.

The first packet expanded on the Trace display is from the first line on the data display, identified on the status line as LN=XXXX. This makes it easy to move between the data display and the two trace displays without losing sight of a particular frame or packet. Simply move the desired data or trace line up to the first line of the display before you press "1," "2," "3" or "4" to see the other display. The first line of the new display will contain the frame or packet that interests you.

You can leave HEX ON while protocol trace is displayed, so that you can see the data in hexadecimal just by pressing the "1" key.

```
ASCII/8/NONE/BOP                    LN=0072
LINE  LCN  TYPE          PR   PS  QDM
DTE   01F  RR             5
DCE   01F  DATA            4    3
DTE   01E  DATA           3     0
DCE   001  DATA            0    3
DTE   000  RSTRT   %05
DCE   000  RSTRT C
DTE   01F  CALL
DCE   01F  CLEAR   %42
DTE   01F  CLEAR C
DTE   01F  CALL
DCE   01F  CALL ACC
DCE   01F  DATA            0    2  Q
DTE   01F  RR             1
DCE   01F  DATA            0    1  Q
DCE   01F  DATA            0    2  Q
DTE   01F  DATA           1     0  Q
```

Figure 16-6 Packet-level protocol trace display.

```
ASCII/8/NONE/BOP                          LN=0072
ADR  LCN  TYPE  PR  PS  QDM  NR  NS  P
R03  01F  DATA   4   5        6   2  0
T03       RR                 4       0
T01  01F  RR     3            1   6  0
T01  01E  DATA   2   0        1   7  0
R01       RR                 7       0
R01       RR                 0       0
R03  001  DATA   0   2        0   1  0
T03       RR                 2       0
R03  01F  DATA   4   4        0   2  0
R03       RR                 0       1
R03       RR                 0       1
T01       DISC/RD                    0
R01       UA                         0
T01       SABM                       0
R01       UA                         0
T01  000  RSTRT %05          0   0   0
```

Figure 16-7 Combined frame-and-packet trace display.

PART IV
THE TRIGGERS

17 THE TRIGGER CONCEPT

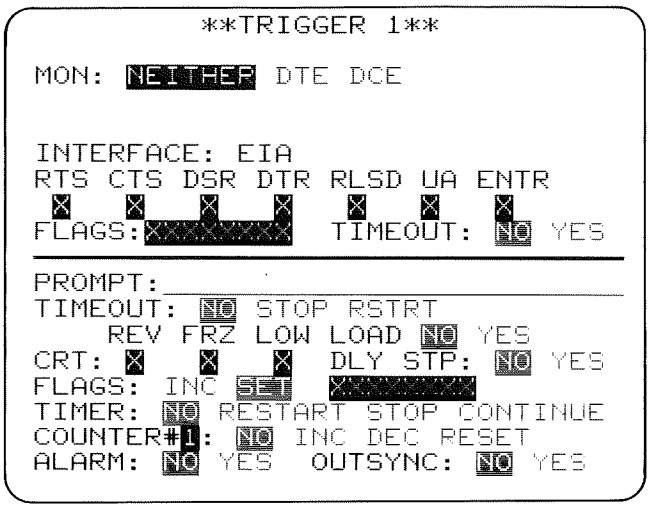


Figure 17-1 Each trigger is divided into conditions (top) and actions (bottom).

17
THE TRIGGER CONCEPT

The COMSTATE I employs the simple, nonsequential programming technique of triggers. With a trigger you specify the condition or combination of conditions you wish the trigger to look for, and what actions you wish it to take when all the conditions are found.

In normal operation, each one of the COMSTATE I's eight triggers is constantly scanning all data looking for its particular set of conditions. When an individual trigger's conditions are met, that trigger's actions are performed independently of the other triggers. Sometimes, however, you may want two or more of the triggers to work sequentially. This may be accomplished with the "flag," an 8-bit counter solely manipulated by the triggers. (This "flag" is not to be confused with the 7E flag used in Bit-Oriented Protocols.)

The triggers are accessed from the Program 1 Triggers screen. Display any trigger menu by pressing the PROGRAM key followed by 1 to bring up the Triggers screen, and then the trigger's identification number.

NOTE: To clear all eight triggers simultaneously, press PROGRAM, 1, CTRL CLEAR.

Each trigger menu (Figure 17-1) is divided into two halves: The top half contains the Conditions selections; the bottom half contains the Actions selections.

Triggers look for any or all of five conditions: specific characters or combinations of characters from either the DCE or DTE, interface lead status, status of the ENTER key, status of eight internal flags, and timeout of a special timer. For a trigger to take action, all conditions selected must be true.

Trigger actions fall into nine categories: displaying a message to the operator (Prompt), sounding an alarm, controlling the CRT data display, driving a receiver out of synchronization, setting the internal flags, controlling four counters and one timer for statistical measurement, controlling the timeout timer, and loading programs from the expansion memory.

Message-transmission conditions and actions are programmed on another menu, the Interactive Test menu. Trigger conditions can be used as conditions on the Interactive Test menu (see Section 23.14).

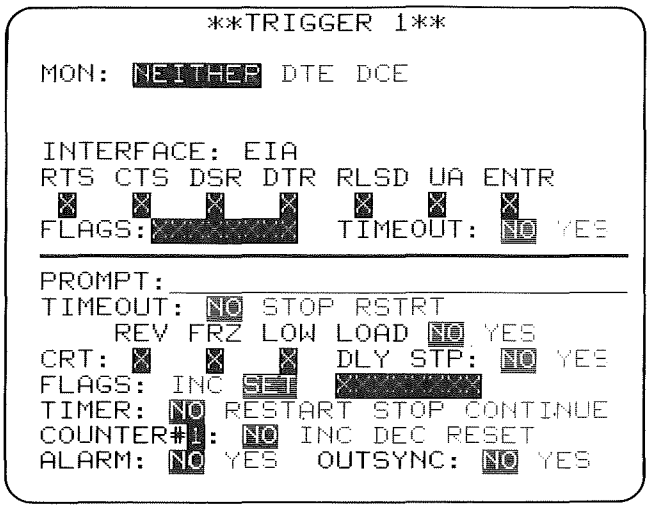


Figure 18-1 The default trigger menu.

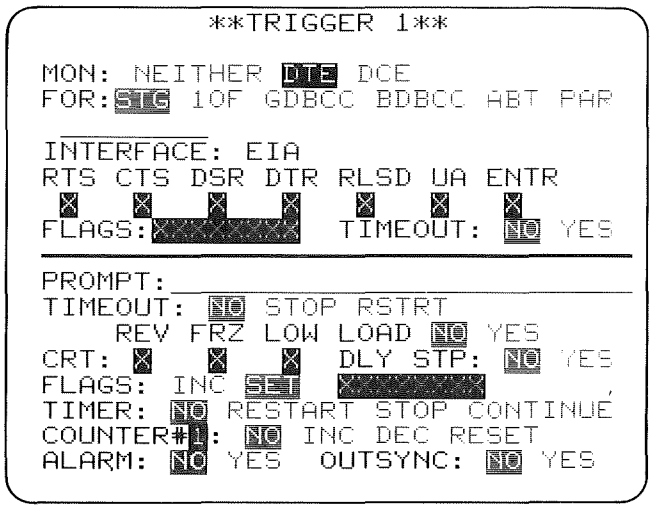


Figure 18-2 Selecting MON:DTE (or DCE) displays FOR field.

18
SELECTING TRIGGER CONDITIONS

Figure 18-1 is a default trigger menu. On the top half of the menu are the conditions the COMSTATE I will look for. All conditions selected must be satisfied for the trigger to be true. Only then will the actions on the lower half of the menu be taken.

18.1 LOOKING FOR DATA CONDITIONS

When you want a trigger to monitor the data on either the DTE or DCE side of a data line, use the fields on Lines 3, 4, and 5. A trigger cannot look at both data leads simultaneously, but you can use two triggers if you want the COMSTATE I to look at both sides of the line.

18.1.1 Monitor (Line 3)

If you select NEITHER, data will not be used as a trigger condition. When you move the cursor to DTE or DCE, a new field appears on Lines 4 and 5 (compare Figures 18-1 and 18-2).

If you select DTE, then TD (T in X.21) will be monitored for the condition selected on Line 4. Similarly, when you select DCE, RD (R in X.21) will be monitored for the condition selected on Line 4.

Each trigger can monitor either the COMSTATE I's own transmissions or the received data.

18.1.2 For (Line 4)

On this line, select the data you want the trigger to look for on the TD or RD (T or R) lead. The selections are as follows:

(a) String. The default selection is STG, which allows you to enter a string of up to eight characters on the next line. (See Section 18.1.3 for the list of legal characters.) The entire, exact sequence of characters entered must be received for the condition to be true.

(b) "One of" Character. When "1OF" is selected, the trigger looks for any one of the characters in the list of up to eight characters entered in the next field. (See Section 18.1.3 for the list of legal characters.)

(c) Good or Bad Block Check. GDBCC (GooD Block Check Character) and BDBCC (BaD Block Check Character) can only be used as conditions when Received Block Check is ON (Protocol Setup menu; see Section 9).

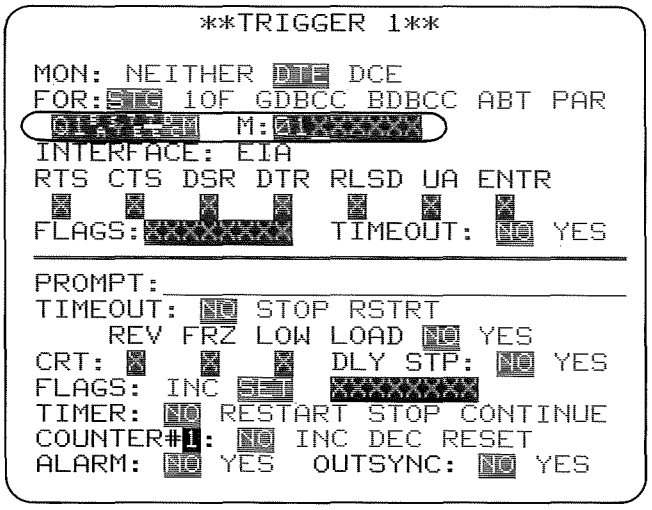


Figure 18-3 Each type of string entry.

Select GDBCC or BDBCC when you want the trigger to take action on receipt of the BCC. The COMSTATE I does the appropriate block check calculation for the CODE and FORMAT selected on the Protocol Setup menu and compares it with the received block check characters. (See Table 9-1 for the block check calculations done by the COMSTATE I.)

(d) Aborted Block. When BOP or BOP/NRZI has been selected for FORMAT on the Protocol Setup menu, you can choose ABT as a trigger condition. In BOP or BOP/NRZI, seven consecutive "1" bits always constitute an ABORT.

(e) Parity Error. PAR selects parity or framing error as a trigger condition. The logic automatically computes parity in accordance with your selections on the Protocol Setup menu.

18.1.3 Character-Entry Field (Line 5)

This is the data-entry line for a character string, if STG has been selected, or for a character list, if "1OF" has been selected. Up to eight characters may be entered.

(a) String Entry. A string must be received in the exact order it is entered in this field for the condition to be true. The eight characters allowed in the string may include any of the following in any order or number (see Figure 18-3 for an example of each):

- All upper- and lower-case alpha characters and numerals.
- All control character mnemonics.
- Two-digit hexadecimal entries. Characters entered in hexadecimal (HEX key ON) are not translated and parity is not calculated for them.
- Flags. Always use the FLAG FOX key to enter the 7E (hex) Flag byte used to frame bit-oriented protocols. Because of zero-insertion, the logic will not read the key sequence HEX, 7, E as a Flag.
- Not Equal entries. If you press the NOT EQUAL (≠) key before a character key, all characters not equal to that character will satisfy that position in the string. In the data-entry field, that character will be displayed with a bar through it.
- Don't Care entries. The DON'T CARE key permits any character received in that position in the string to satisfy the condition. A Don't Care character is represented in the data-entry field by a low-intensity reverse-image DC.
- Bit Mask. This allows you to select the status of specific bits in a character. To enter a Bit Mask, use the BIT MASK MSG key at the desired location in the string. Not Equal Bit Mask is a legal string entry. Bit Mask fields are explained in Section 11.2.

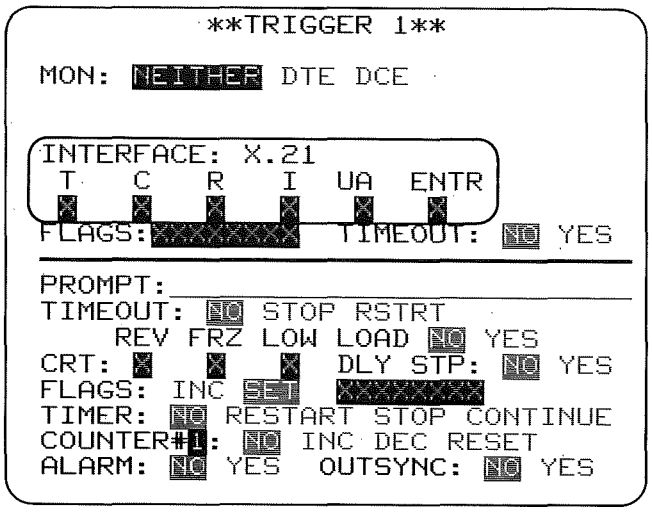


Figure 18-4 X.21 INTERFACE field appears when you select X.21 connector on Protocol Setup menu.

Table 18-1
X.21 AND TRIGGER LEAD EQUIVALENTS

X.21		COMSTATE	
Lead	State	Trigger Menu Selection	Status LED
T	0	0	ON
	1	1	OFF
C	ON	0	ON
	OFF	1	OFF
R	0	0	ON
	1	1	OFF
I	ON	0	ON
	OFF	1	OFF

NOTE: The logic will look for the exact bit patterns and sequence of characters that you enter. Therefore, the following two points are important: (1) In transparent BISYNC protocols, the communications equipment may insert characters in the data: DLE or DLE SYN, for example. The COMSTATE I will not be able to find a string with inserted characters unless they are specified in the character-entry field. (2) The COMSTATE I will not be able to find a character with a parity error unless you enter a hexadecimal number that matches the errored character bit for bit.

(b) "1 OF" Character Entry. Up to eight characters may be entered from the same list as for strings (see (a) above). The condition will be true upon receipt of the first character to match any one of the characters in the list.

If Don't Care is used, only one character should be entered. If all characters are entered as Not Equal, a match is found on each character that is not any one of the characters entered.

18.2 MONITORING X.21 INTERFACE LEADS

When CONNECTOR: X.21 is selected on the Protocol Setup menu, the X.21 INTERFACE field appears on lines six through eight of each Trigger menu (see Figure 18-4). Use the INTERFACE field to monitor status of the X.21 interface leads or to look for status of the ENTER key. The trigger will look for the specific pattern of voltages corresponding to the lead status and ENTER-key status that you select on Line 8. If the only condition selected on a trigger is status of one interface lead, then the trigger will be true when it sees the transition to that state. If another condition (or conditions) is selected with one interface lead, then the trigger will look for the state of the interface lead when the other condition(s) is true.

NOTE: Logic 0 and 1 imply that a lead is either at plus or minus voltage in accordance with the X.21 standard. A signal is at logic 1 (or OFF) when the A lead is more negative than -0.3 volt with respect to the B lead. Logic 0 (or ON) means that the A lead is more positive than +0.3 volt with respect to the B lead.

All X.21 leads are active at logic 0. On Line 8, enter a "0" in the box under a lead to indicate active, a "1" for inactive. See Table 18.1. No entry (X) will be read as Don't Care: The trigger logic will not look at this lead. There are entry fields for four leads: T (pins 2 and 9), C (pins 3 and 10), R (pins 4 and 11), and I (pins 5 and 12).

You may monitor a sixth X.21 lead by patching the desired lead to the UA input jack on the interface panel and entering "1" or "0" in the UA box in the INTERFACE field. Triggers can detect glitches at this input. See Section 3 for a discussion of the COMSTATE I's interface panel and the glitch catcher.

18.3 MONITORING RS-232 OR V.35 INTERFACE LEADS

When CONNECTOR: RS-232, MIL, or V.35 is selected on the Protocol Setup (Program 0) menu, the INTERFACE: EIA field appears on lines six through eight of the Trigger menus (see Figure 18-5). Use the INTERFACE field to monitor status of the RS-232 or V.35 interface leads or to look for status of the ENTER key. The trigger will look for the specific pattern of voltages corresponding to the lead status and ENTER-key status that you select on Line 8. If the only condition selected on a trigger is status of one interface lead, then the trigger will be true when it sees the transition to that state. If another condition (or conditions) is selected with one interface lead, then the trigger will look for the state of the interface lead when the other condition(s) is true.

NOTE: "1" and "0" imply that a lead is at either plus or minus voltage in accordance with the RS-232 and V.35 standards. For RS-232 and V.35 control leads, a signal is at minus voltage if it is more negative than -3 volts with respect to signal ground. It is at plus voltage when it is more positive than +3 volts with respect to signal ground. MIL standards agree with RS-232 logic for control leads.

On Line 8, enter a "1" in the box under a lead to indicate positive voltage, a "0" for negative voltage. All these EIA leads are active at plus voltage. No entry will be read as Don't Care: The trigger logic will not look at this lead. There are entry fields for five leads: RTS (Pin 4), CTS (Pin 5), DSR (Pin 6), DTR (Pin 20), and RLSD (Pin 8).

You may monitor a sixth EIA lead by patching the desired lead to the UA input jack on the interface panel and entering "1" or "0" in the UA box in the INTERFACE field.

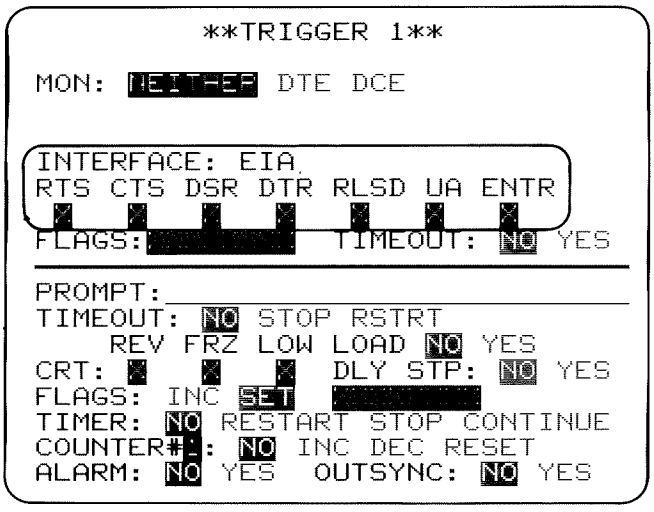


Figure 18-5 EIA INTERFACE field appears when you select RS-232, V.35, or MIL connector on Protocol Setup menu.

NOTE: Like other EIA leads, data leads are active at plus voltage and idle at minus voltage. Their logic is inverted, however, and so they idle FF instead of 00. For purposes of triggering, active is "1" and idle is "0."

Triggers can detect glitches at this UA input. See Section 3 for a discussion of the COMSTATE I's interface panel and the glitch catcher.

18.4 MANUAL CONTROL

You can use the INTERFACE field to obtain manual control of trigger actions. When you put a "1" in the ENTR box, the trigger will look for the ENTER key to be depressed. This effectively gives you manual control of trigger actions, for the trigger conditions cannot be true until, in Run Mode, you press the ENTER key. Only "1" and "X" (Don't Care) are valid for ENTR.

18.5 MONITORING INTERNAL FLAGS (Line 9)

An internal flag is a bit that a trigger can set ON or OFF and can be monitored by either another or the same trigger. Flags may be used to control program operation or to provide a link between triggers.

There are eight internal flags in the COMSTATE I and they all may be monitored by one trigger, or all set by one trigger, or monitored and set in any combination by different triggers. All flags are set to zero when the COMSTATE I enters Run mode or if the RUN key is pressed when the unit is already in Run mode. In the flag mask enter a "1" to look for a flag ON, a "0" to look for a flag OFF, or "X" for Don't Care (see Figure 18-5).

If a flag is the only condition entered on a trigger menu, then the trigger will look for the transition from 0 to 1 or 1 to 0. If more than one flag condition is entered, then the trigger will look for the last transition necessary to match the flag mask. If the trigger is looking for both a flag (or flags) and another condition, then it will look for the state of the flag (or flags) when the other condition comes true.

NOTE: If a FLAG condition is used with a MONITOR (string or character-type; Line 4) condition, then the flag is tested when the monitor condition has been satisfied. The flag condition is not tested on each character of a string.

18.6 TIMEOUT (Line 9)

When TIMEOUT: YES is selected, the trigger looks for the timeout timer to time out. The timeout timer may be set on another trigger (see Section 19.2) or on the TIMEOUT selection on the Interactive Test menu (see Section 23.6). The default selection for TIMEOUT is NO.

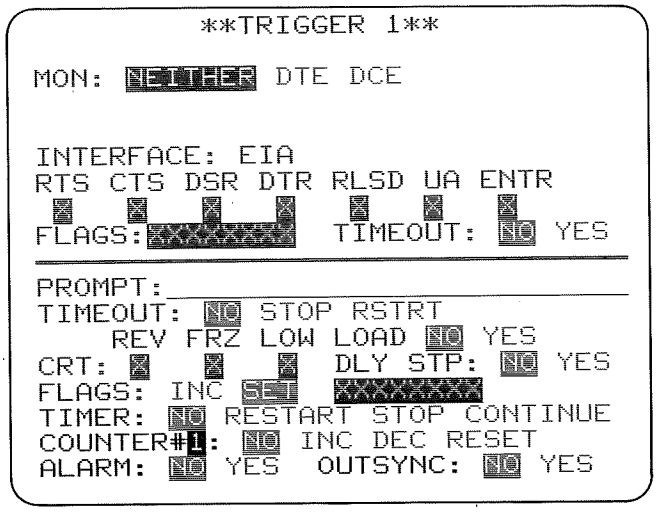


Figure 19-1 Default trigger menu.

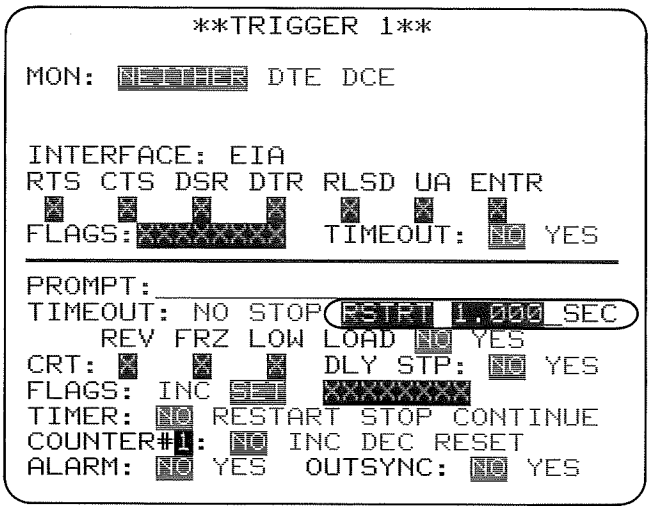


Figure 19-2 Setting a timeout.

19
SELECTING TRIGGER ACTIONS

Figure 19-1 is a default trigger menu, showing the action selections on the lower half of the menu. When all conditions selected on the top half of the trigger menu are true, the actions will be taken. Details of the action sequence are explained in Section 20.

19.1 DISPLAYING A PROMPT (MESSAGE TO THE OPERATOR)

On this data-entry line you may enter a message to the operator of up to 25 characters. When the trigger is true, this Prompt will be displayed on line 1 of the CRT. It will stay on the display until it is replaced by another prompt or until you clear it by pressing the RUN key.

PROMPT is an ASCII-character field: only alphanumeric and control mnemonic characters are legal.

19.2 CONTROLLING THE TRIGGER TIMEOUT TIMER

The COMSTATE I has a timer dedicated to the timeout function; that is, it may be set to "time out" at a specified value. The timeout value may be set by a trigger, or by a TIMEOUT selection on the Interactive Test menu (see Section 23.6). On a trigger, enter the duration of the timeout by moving the cursor to the TIMEOUT:RSTRT field (Figure 19-2). The timer is a decimal field in which you may enter up to 6 digits. The maximum value for a single timeout is 65.53 seconds. The default timeout value is 1 second.

There is only one timeout timer in the COMSTATE I. When more than one timeout value is activated either on the triggers or on the Interactive Test menu, only the last value to be triggered is operative. If triggers come true simultaneously, the COMSTATE I first compiles Trigger 1, then Trigger 2, and so on; thus the last trigger timeout value is the operative one. The Interactive Test TIMEOUT selections then take precedence over the trigger timeout values.

It is possible to obtain timeouts longer than 65.53 seconds by using the flags to look for multiple occurrences of the timeout. The maximum is 256 (which is the maximum value of the flag mask) times 65.53 seconds or approximately 280 minutes. This use of flags is explained in Section 19.5.

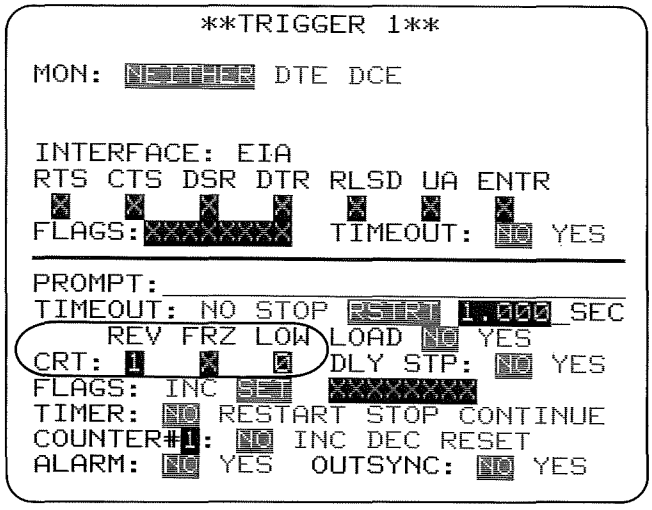


Figure 19-3 Setting a CRT action (reverse video, regular intensity).

STOP: When STOP is selected, the trigger stops the timer -- which has been started by another trigger -- and the timeout condition does not occur.

RESTART: When RESTART is selected, the trigger sets the timeout timer to the value selected and it begins to decrement.

The default selection is NO. The trigger will not control the timer when NO is selected.

19.3 LOAD

The LOAD selection loads a test program or setup automatically from the expansion memory, then enters Run mode.

The programs are identified by a three digit number that combines the Slot and Record designations used in the Test Library menu. See Section 29.3.

19.4 CONTROLLING THE CRT

Triggers can be used to enhance data selectively or display specific data on the CRT. Control of the CRT does not affect counter and timer operation. The 512-character (32 x 16) display and the 32,768-character (64-page) display buffer are controlled together.

To turn a CRT action ON (see Figure 19-3), enter a numeral "1" in the corresponding box on Line 13; to turn an action OFF, enter a zero ("0"). An "X" (or the DON'T CARE key) means no action will be taken.

(a) Reverse Image. Reverse-imaged characters are presented in black on a light background. REVerse image is very effective when used in combination with low intensity, but hard to read if it occurs over a large area of the screen.

(b) Freeze. When FRZ is on, no new data is received by the CRT buffer or displayed until freeze is turned off. However, the data withheld from the CRT during trigger freeze is still received by the trigger logic and the program continues to operate, so valid counter and timer data will still be furnished.

Trigger freeze usually should be turned off by another trigger. It can be canceled manually with the RUN key, but this always resets the program.

See Section 14 for more about Freeze.

(c) Low Intensity. LOW intensity is useful for displaying data of lesser importance. In combination with reverse image, however, it creates a highlight that is immediately noticeable.

(d) Delay Stop. If DLY STP:YES is selected, 256 more characters are added to the display when the trigger conditions are true. The receivers are then driven out of synchronization so no new data is presented either to the trigger logic or to the CRT buffer. In Delay Stop mode, you have access to all 64 pages of data in the COMSTATE I's CRT data buffer. For more about this, see Section 14.

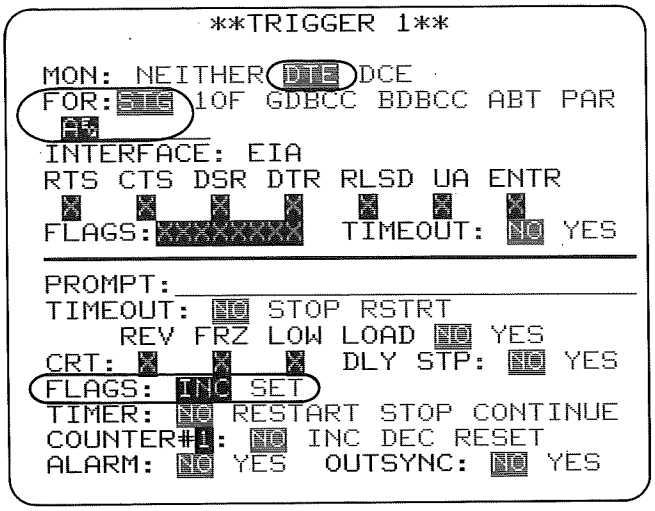


Figure 19-4 Trigger 1 looks for a poll and increments the flag.

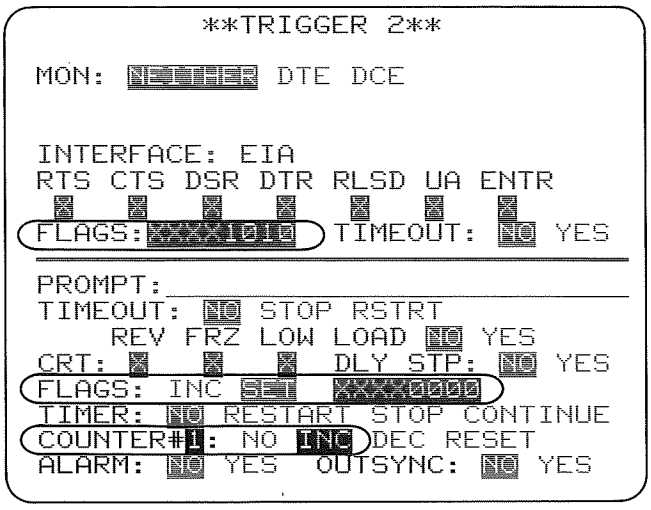


Figure 19-5 When flag count equals ten (XXXX1010), Trigger 2 increments the counter and resets the low-order flag bits.

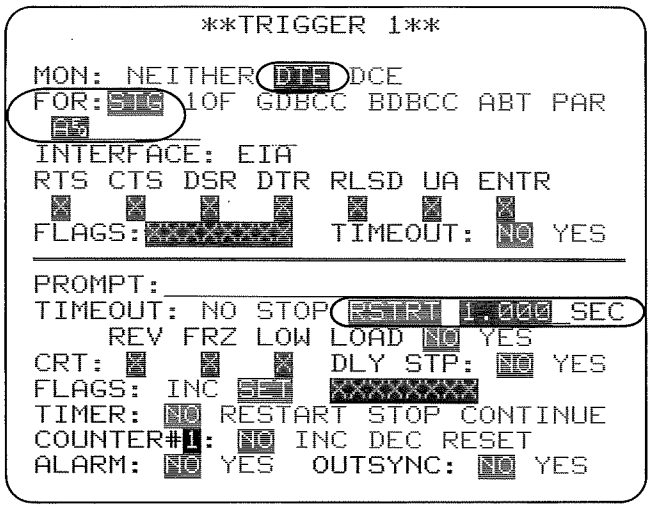


Figure 19-6 Trigger 1 looks for a poll and starts the timeout timer.

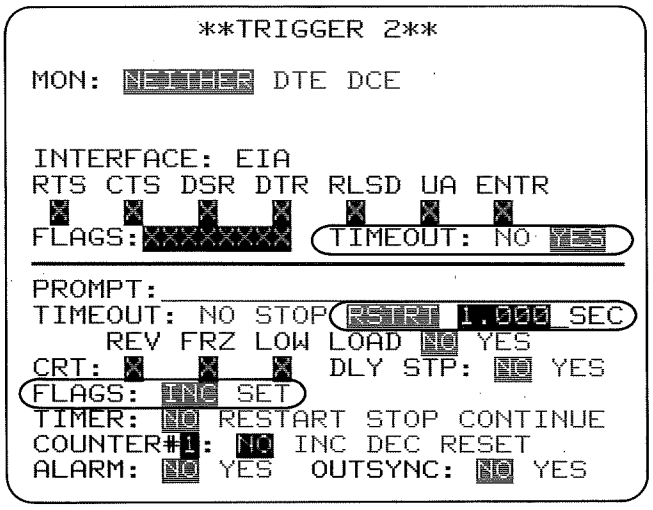


Figure 19-7 Trigger 2 waits for the timeout, restarts the timeout, and increments the counter.

19.5 SETTING FLAGS

Flags are bits that can be set on or off by the program. The COMSTATE I has eight flags. There are two choices of FLAG actions: The trigger can INCrement the flags, or it can set specified flags ON or OFF. When the program is reset by the RUN key, all flags are set to 0 (off).

(a) Increment Flags. INC can be used to control recursive routines. Each time the trigger conditions are satisfied, the value of the flag mask, considered as a binary number, will increment by one.

NOTE: The high-order bit is on the left (Flag 8); the low-order bit on the right (Flag 1).

To reset Flags, SET them to all zeroes. See (b), below.

(b) Set. To turn specified flags on or off, select SET; then use the ENTER key to move the cursor to the field of eight numbered boxes. Enter a "1" under the number of any flag, or flags, that you want the trigger to turn on; a "0" for any flag, or flags, you wish turned off. "X" means Don't Care: the trigger will not change the status of this flag. The trigger action will be to set the flags according to the mask you have entered. The initial flag status when the COMSTATE I first enters Run mode is all flags OFF.

SET entries will remain dormant if you select INC. When you select SET again, your flag mask entries will reappear.

(c) No Flag Action. Choose SET with all flags X (Don't Care).

(d) Example: Counting with Flags. Suppose that you wanted to count polls over an extended period of time. The maximum counter value is 9999, but using flags you can multiply this by as much as 256, which is the maximum value of the flag mask. The example shown in Figures 19-4 and 19-5 uses both the INC and the SET actions to increase counter capacity by a factor of 10.

Trigger 1 looks for the poll from DTE and increments the flag mask upon receipt of each poll. When 10 polls have been received, Trigger 2 sees the flag mask increment to XXXX 1010 (decimal value 10) and increments the counter once. It also resets the flag mask to XXXX 0000 so that it can start counting again upon receipt of the next poll.

When you read the counter, remember to multiply the displayed value by 10 to find the actual number of polls.

(e) Example: Increasing the Maximum Timeout. Figures 19-6 through 19-8 illustrate how the flag increment action can be used to increase the length of a timeout. Once the timeout timer is started (Trigger 1), the timeout is used as the condition to restart the timer (Trigger 2) and increment the flag mask, and any duration up to 256 x TIMEOUT can be used as the condition for the desired action (Trigger 3). Trigger 3 could be used as the condition for a transmission (see Section 23.13).

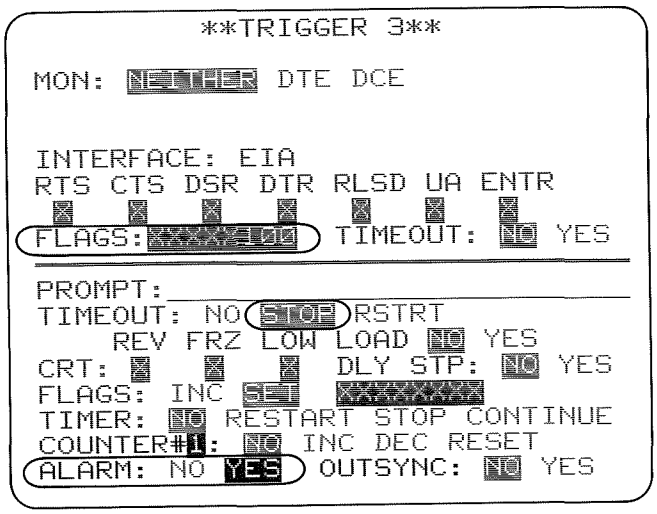


Figure 19-8 Trigger 3 lets the flag increment to four (XXXXX100); then stops timeout timer and sounds the alarm. Trigger 3 could be a condition for a transmission on the Interactive Test menu.

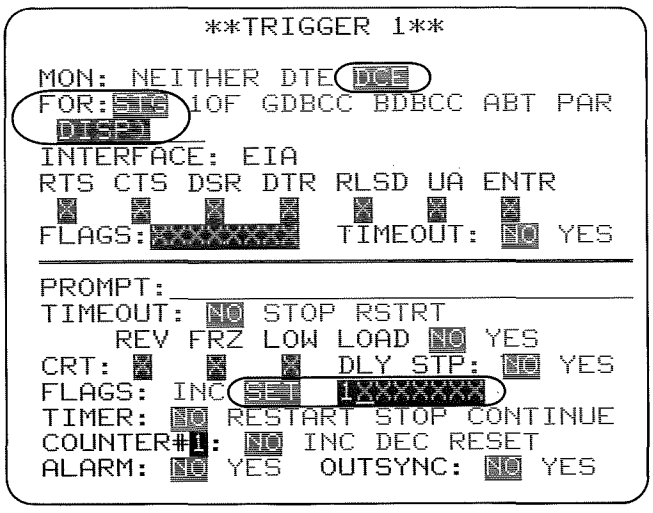


Figure 19-9 Trigger 1 looks for a string and sets the flag to 1.

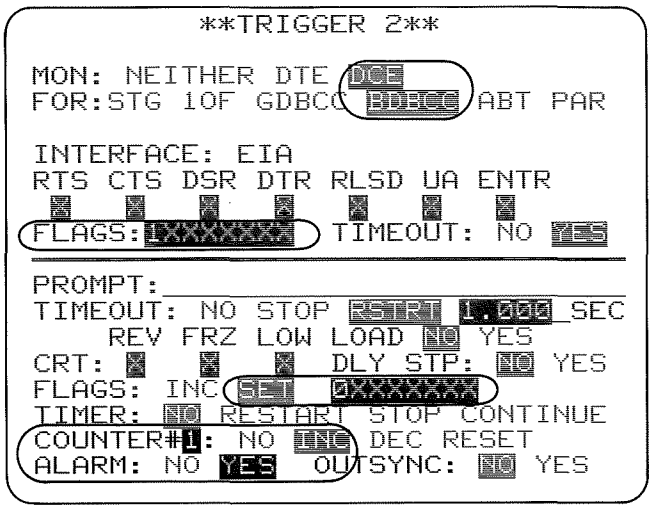


Figure 19-10 Trigger 2 looks for a BDBCC while flag is set to 1. If found the alarm sounds, counter increments, and flag resets to 0.

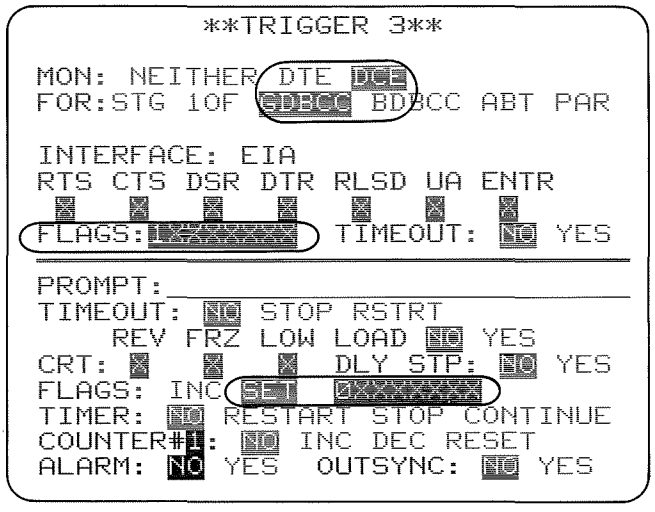


Figure 19-11 If the message block where the string was found has a good BCC, Trigger 3 resets the flag to 0.

(f) Example: Program Control with a Flag. Suppose you suspected that a bad BCC always followed a certain string. One trigger cannot look for both a string and a BCC. To do this, we SET a single flag to link the two conditions. Our example is shown in Figures 19-9 through 19-11.

Trigger 1 looks for the DCE string DISP) and turns Flag 8 on. Trigger 2 looks for a bad BCC from DCE while Flag 8 is on. It sounds the alarm and increments the counter each time the conditions are true.

In addition, it turns Flag 8 off so that Trigger 2 cannot be true again until Trigger 1 has found another DISP). Trigger 3 prevents Trigger 2 from counting BCCs that are not on the same block as the string (Figure 19-11).

(g) Auxiliary Output. When FLAGS:SET is selected, an output on Pin 7 of the COMSTATE I's AUXILIARY connector (on the rear) follows the status of Flag 1, that is, the right-most flag in the mask. When this flag is set to 1, the output will be +5 volts and when the flag is set to 0, the output will be 0 volt. The output driver is a 74LS04 which can sink up to 8 mA. Ground on the auxiliary connector is on Pin 6.

The FLAGS:INC action will not cause any auxiliary output.

19.6 CONTROLLING THE TIMER

The COMSTATE I has one timer for statistical measurements, which is controlled by the TIMER field. This timer is separate from the Trigger and Interactive Test timeout timer. The default selection for the timer is NO. When the timer is set, the real-time readings will be displayed on Line 2 of the Run-mode CRT display (see Section 12.2). The maximum value for the timer is 9999.

(a) RESTART causes the timer to reset to 0 and begin counting.

(b) CONTinue causes the timer to begin adding to the existing count.

(c) STOP stops the timer. If the timer overflows, the display remains at 9999 and and blinks until the timer is reset.

NOTE: The timebase is 1 msec. If the durations are less than 1 msec, a rounding effect occurs, where some shorter periods are missed and others counted. This effect will usually average out for counts above 100. Since the 1-msec timebase runs continuously and is not initialized for each measurement, the accuracy of measurements will always be plus or minus 1 msec.

19.7 CONTROLLING THE COUNTERS

The default Counter number is 1. The default selection for this counter is NO. To designate a counter other than 1, move the cursor to the blinking counter number and overwrite the 1. Numbers 1 through 4 are legal.

Each counter's reading is displayed during Freeze or Program mode on the Statistics menu (Program 2) screen. See Section 13. Each reading may also be displayed on the real-time data screen. While the unit is in Run mode, simply press the key, 1-4, that corresponds to the counter number. The counter number and the real-time values will be displayed on Line 2.

The maximum count is 9999. The minimum is 0.

INCREMENT. When INC is selected, each trigger occurrence adds 1 (one) to the counter value.

DECREMENT. When DEC is selected, each trigger occurrence subtracts 1 (one) from the counter value.

RESET sets the counter to 0 (zero).

If the counter overflows, that is, increments beyond 9999 or decrements below 0000, the displayed reading wraps back to the initial value (0000 for INC; 9999 for DEC). It continues to increment or decrement but the display blinks until the counter is reset.

19.8 SETTING AN ALARM

In this field, YES selects an audible alarm as the trigger action. There are Remote-port functions associated with this trigger action also. See Sections 32.4 and 32.6.

19.9 FORCING A RECEIVER OUT OF SYNCHRONIZATION

When OUTSYNC is selected, the DCE (RD or R) or DTE (TD or T) receiver, whichever is selected as the Monitor condition, goes out of synchronization from trigger true until it sees the next synchronization pattern. While the receiver is out of synchronization, no data from that side of the line is presented to the COMSTATE I display, to the triggers, or to the Interactive Test program (unless DISPLAY IDLE has been selected on the Protocol Setup menu).

This action is useful when the information after a header group is of no interest, but you need to see data on the other side of the line. Freeze would inhibit addition of data on both sides of the line.

When ASYNC has been selected on the Protocol Setup menu, OUTSYNC is not a valid trigger action. OUTSYNC should not be selected on the same trigger as INTERFACE conditions.

20 TRIGGER TIMING AND SEQUENCE

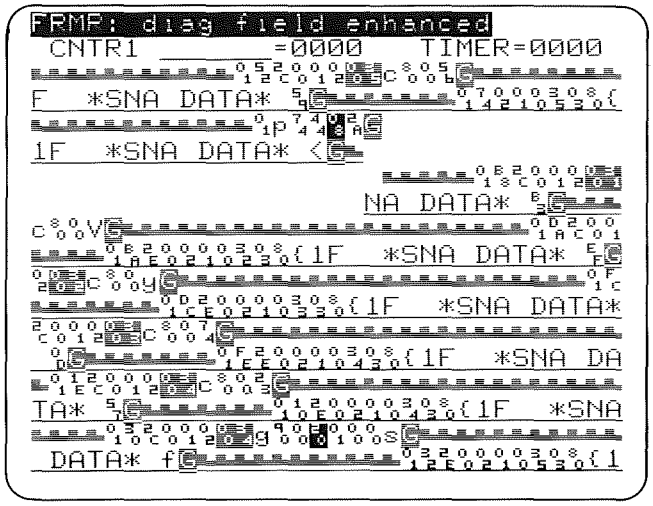


Figure 20-1 DTE sequence-number, FRMR diagnostic field, and first byte of sense data enhanced.

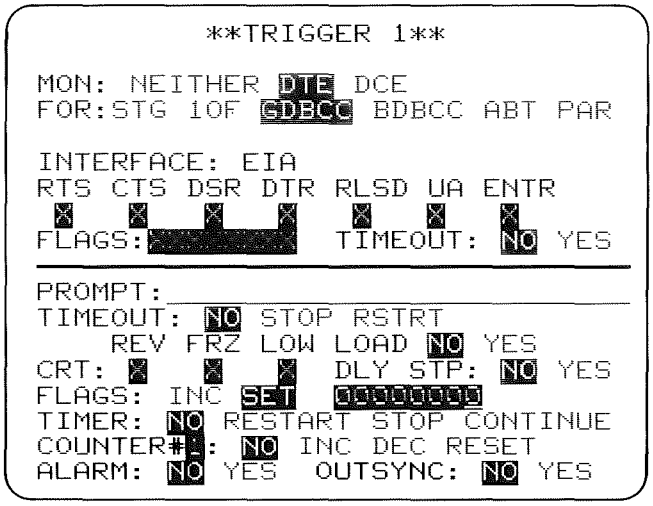


Figure 20-2 Trigger 1 looks for a DTE good BCC and sets FLAGS to all zero.

20
TRIGGER TIMING AND SEQUENCE (TECHNICAL NOTES)

Although all triggers are simultaneously active, there is an order in which they are processed. The order of trigger processing is significant only in special situations (as in Section 20.2).

20.1 ORDER OF PROCESSING

Basically, the triggers are first evaluated in their numerical order for their conditions to be true; then the trigger actions are taken in order. This process permits one internal flag to be both sensed and set by the same trigger.

As each data character is reviewed, the COMSTATE I will

(1) Evaluate triggers that do not look for data.

(2) Evaluate triggers that look for DTE data.

(3) Evaluate triggers that look for DCE data.

(4) Set all actions applicable for each trigger in numerical order.

20.2 A TRIGGER-SAVING TECHNIQUE

Usually the timing described in Section 20.1 is not important. Under certain circumstances, however, particularly when you are trying to economize on triggers, these timing relationships can give rise to special programming techniques.

For example, look at the SNA display in Figure 20-1. The trigger program is enhancing three distinct fields. Near the top of the display, the diagnostic field in a FRaMe Reject frame (hex 08) is enhanced. (This decodes as "Incongruous NR.")

Apart from the FRMR, each DTE message on the screen has two consecutive bytes enhanced in low-reverse video. This is the SNA sequence-number field. Near the bottom of the display, the first byte in a sense-data field is enhanced. This is a negative SNA response: the sense code 2001 means "Sequence Error."

Normally the operator would need eight triggers to perform these enhancements. Two triggers would find the

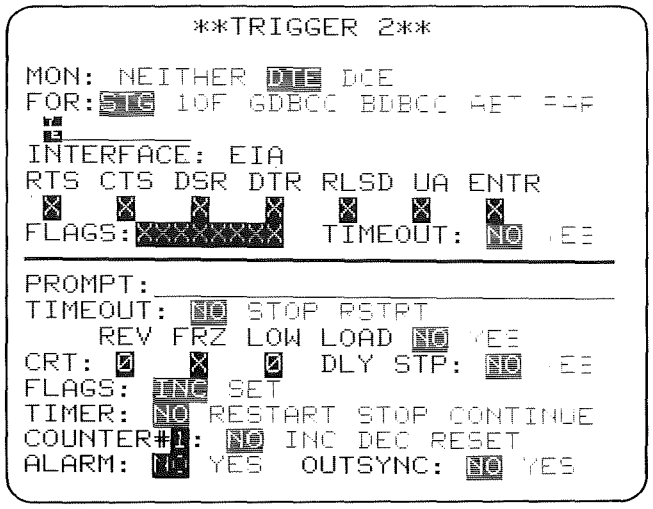


Figure 20-3 Trigger 2 looks for any not-7E flag, and increments FLAGS; it also turns OFF all CRT enhancements.

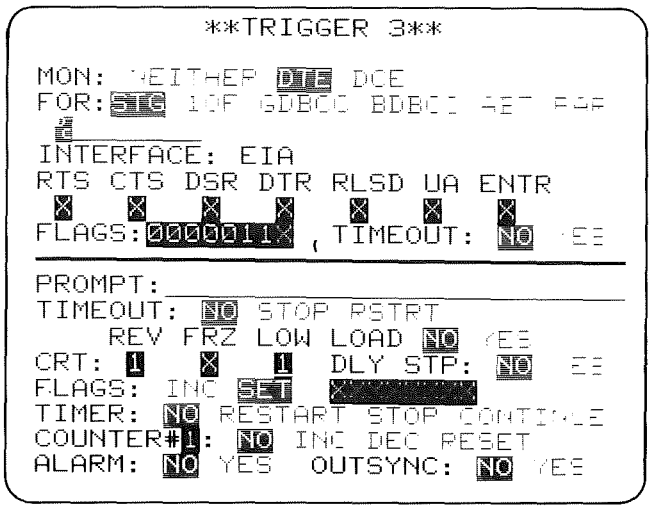


Figure 20-4 Trigger 3 looks for seventh and eighth characters in frame and turns low-reverse enhancement ON after each one.

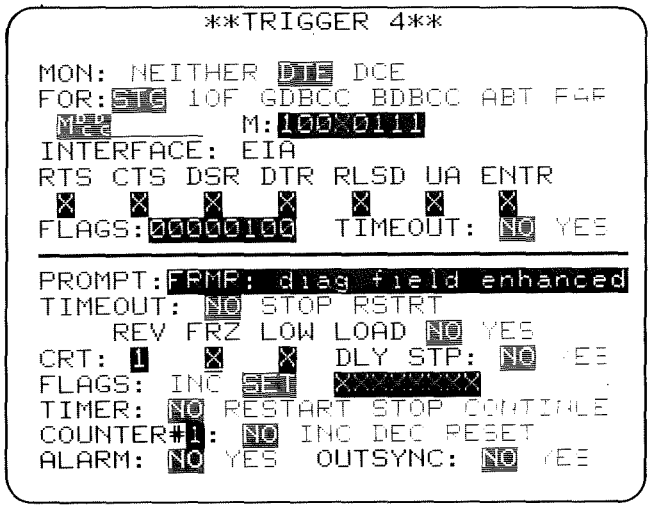


Figure 20-5 Trigger 4 looks for FRMR and turns reverse-video enhancement ON.

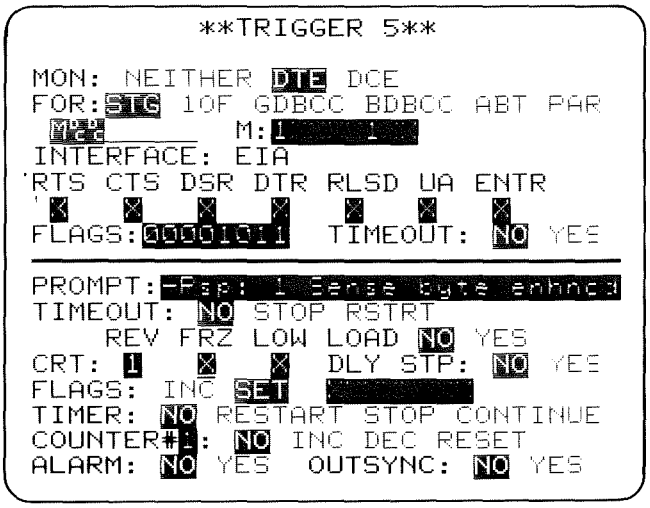


Figure 20-6 Trigger 5 looks for Response RH and for Sense Data Indicator and turns enhancement ON.

start of each DTE frame and count characters from the beginning of the frame. And the three enhancements would require two triggers each, one to turn the enhancement on, a second to turn it off.

An insight into the way simultaneous triggers are executed can help eliminate three of these triggers. The technique is demonstrated in Figures 20-2 through 20-6.

Trigger 1 looks for a good block check on the DTE side. When it sees one, it sets the FLAGS counter to all zeroes.

Trigger 2 looks for any character not a 7E flag. When it sees one, it increments the FLAGS counter. This trigger has the effect of maintaining a count of characters in a frame. Since the trigger ignores 7E flags, the program will work on live data (with 7E flags) or on Reanalyze data (often without 7E flags; see Section 15.3).

Note that Trigger 2 also turns off any enhancement of characters. This is the only place in the program where these enhancements will be turned off.

Trigger 3 looks for any DTE character that comes along when the FLAGS counter stands at 6 or 7. In other words, this trigger will be true for two consecutive characters in the DTE frame. These characters correspond to the sequence-number field. When Trigger 3 is true, it turns on the low-intensity reverse enhancement.

Each time Trigger 3 turns on the enhancement, it overrules Trigger 2, which has just turned the enhancement off (as it does on receipt of every character). When two triggers are true simultaneously, they perform their actions in ascending numerical order.

Trigger 4 looks for an FRMR frame-control byte, waits for two characters, and turns on the full-intensity reverse video, overruling Trigger 2 for the duration of one character.

Trigger 5 looks at the first RH byte for the bit that indicates a Response and for the Sense Data Indicator. It waits two characters and turns the enhancement ON. One character later, Trigger 2 comes true again and turns it OFF.

NOTE: This section has discussed triggers that come true simultaneously with respect to the same character on the same side of the data line. Remember that in dual display, when characters on different sides of the line appear to be simultaneous, the COMSTATE I may not treat them that way, for two reasons. First, the time correlation between the DTE and DCE lines on the display is accurate to ±1 character. Second, the display has a resolution of one character. So although the two lines may be skewed by as little as one bit or by as much as half a character, the display cannot indicate this. The program is executing within microseconds of receiving each character, with much better resolution than is possible on the CRT.

PART V
INTERACTIVE TESTING

TABLE 21-1
RS-232/V.24 INTERFACE LEADS CONTROLLED BY THE COMSTATE I

Lead				TEST DCE	TEST DTE	MONITOR
Pin	Name	EIA	CCITT	Mode	Mode	Mode
2	TD	BA	103	Driven by COMSTATE I	GND via 3.3 kohms	Input to 30-kohm receiver
3	RD	BB	104	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver
20	DTR	CD	108/2	Driven by COMSTATE I	GND via 3.3 kohms	Input to 30-kohm receiver
4	RTS	CA	105	Driven by COMSTATE I	GND via 3.3 kohms	Input to 30-kohm receiver
8	RLSD	CF	109	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver
5	CTS	CB	106	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver
15	SCT	DB	114	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver
17	SCR	DD	115	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver
24	SCTE	DA	113	Driven by COMSTATE I	GND via 3.3 kohms	Input to 30-kohm receiver
6	DSR	CC	107	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver

21
THE INTERACTIVE TEST MODES

With the COMSTATE I you can perform a variety of powerful interactive tests: emulate DCE or DTE to transmit and receive messages, operate as an interactive terminal, or run a Bit Error Rate Test. Setting up one of these interactive tests involves selections on up to four menus: the Protocol Setup menu, the Transmit Mode menu, the Interactive Test menu, and the appropriate Interface Control menu.

The next eight sections of this manual discuss each type of test and menu in detail, for both X.21 and RS-232/V.24 operations. This section covers selections on the Protocol Setup and Transmit Mode menus. Section 22 introduces the concept of testing in states. Sections 23 and 24 cover the setup and use of the Interactive Test menu. Section 25 discusses standard X.21 operations while Section 26 covers RS-232/V.24 and also V.35 operations. Section 27 explains Bit Error Rate Testing, and Section 28 explains how to use the COMSTATE I as an interactive terminal.

21.1 SELECTING THE TEST DIRECTION AND CONNECTING THE COMSTATE I

When the COMSTATE I is monitoring data, it is connected to the X.21, V.35, or RS-232/V.24 interface with a T-cable. To use the COMSTATE I interactively, you must break the line manually (or with the patching equipment at the site) toward either DTE or DCE (see Figure 21-1).

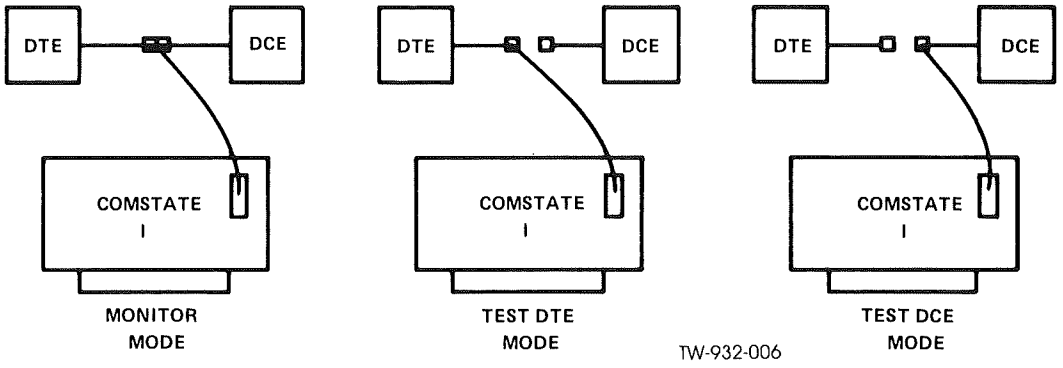


Figure 21-1 Connecting the COMSTATE I to a data line in: (a) MONITOR mode; (b) TEST TERMINAL mode; (c) TEST MODEM mode.

TABLE 21-2
V.35 INTERFACE LEADS CONTROLLED BY THE COMSTATE I

Lead				TEST DCE	TEST DTE	MONITOR
Pin	Name	EIA	CCITT	Mode	Mode	Mode
2	TD	BA	103	Driven by COMSTATE I	470 ohms	Input to 10-kohm receiver
3	RD	BB	104	470 ohms	Driven by COMSTATE I	Input to 10-kohm receiver
20	DTR	CD	108/2	Driven by COMSTATE I	GND via 3.3 kohms	Input to 30-kohm receiver
4	RTS	CA	105	Driven by COMSTATE I	GND via 3.3 kohms	Input to 30-kohm receiver
8	RLSD	CF	109	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver
5	CTS	CB	106	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver
15	SCT	DB	114	470 ohms	Driven by COMSTATE I	Input to 10-kohm receiver
17	SCR	DD	115	470 ohms	Driven by COMSTATE I	Input to 10-kohm receiver
24	SCTE	DA	113	Driven by COMSTATE I	470 ohms	Input to 10-kohm receiver
6	DSR	CC	107	GND via 3.3 kohms	Driven by COMSTATE I	Input to 30-kohm receiver

CAUTION: As soon as the COMSTATE I is in either of its Test modes, it will interfere with any active communications on the interface. Be sure it is all right to break the line and transmit test data on it.

If you want the COMSTATE I to imitate a DCE, select TEST DTE on the Protocol Setup menu. The COMSTATE I will now be able to transmit data, control signals, and clock toward the terminal, using the leads usually controlled by the DCE. To imitate a DTE, select TEST DCE. The COMSTATE I will now be able to control the leads usually controlled by the DTE.

NOTE: To shorten any interruption in communications, you may wish to set up the test menus in the unit before you switch the COMSTATE I to a test mode.

As soon as you enter Run mode, the indicators for the leads controlled by the COMSTATE I will light on the front panel.

NOTE: If the interface leads are not terminated, the indicator readings will be unpredictable.

Table 21-1 specifies which RS-232/V.24 leads are controlled by the COMSTATE I in each Test mode and gives electrical data for them. Table 21-2 deals with V.35 leads. Table 21-3 covers X.21 leads.

21.2 CLOCKING

The COMSTATE I's transmitters will operate off external clock if it is supplied on the interface and CLOCK: EXT is selected on the Protocol Setup menu. If there is no external clock, you must select CLOCK:INT.

TABLE 21-3
X.21 INTERFACE LEADS CONTROLLED BY THE COMSTATE I

X.21 Lead			TEST DCE	TEST DTE	MONITOR
Pin	Name	CCITT	Mode	Mode	Mode
2,9	T	103	Driven by COMSTATE I	470 ohms	Input to 10-kohm receiver
4,11	R	104	470 ohms	Driven by COMSTATE I	Input to 10-kohm receiver
3,10	C	105	Driven by COMSTATE I	470 ohms	Input to 10-kohm receiver
5,12	I	109	470 ohms	Driven by COMSTATE I	Input to 10-kohm receiver
6,13	S	114	470 ohms	Driven by COMSTATE I	Input to 10-kohm receiver

TABLE 21-4
COMSTATE I CLOCKING SELECTIONS

MODE Selection	FORMAT: SYNC or BOP		FORMAT: ASYNC	
	CLOCK: INT	CLOCK: EXT	CLOCK: INT	CLOCK: EXT
MONITOR	Uses internal clock	Uses SCT and SCR	Uses internal clock	Uses SCT and SCR
TEST DTE	Uses internal clock	Uses SCTE	Uses internal clock	Uses SCTE
	Drives SCT and SCR to equal internal clock	Drives SCT and SCR to equal SCTE	Drives SCT and SCR ON (+12 V)	Drives SCT and SCR to equal SCTE
TEST DCE	Uses internal clock	Uses SCT and SCR	Uses internal clock	Uses SCT and SCR
	Drives SCTE to equal internal clock	Drives SCTE ON (+12 V)	Drives SCTE to equal internal clock	Drives SCTE ON (+12 V)

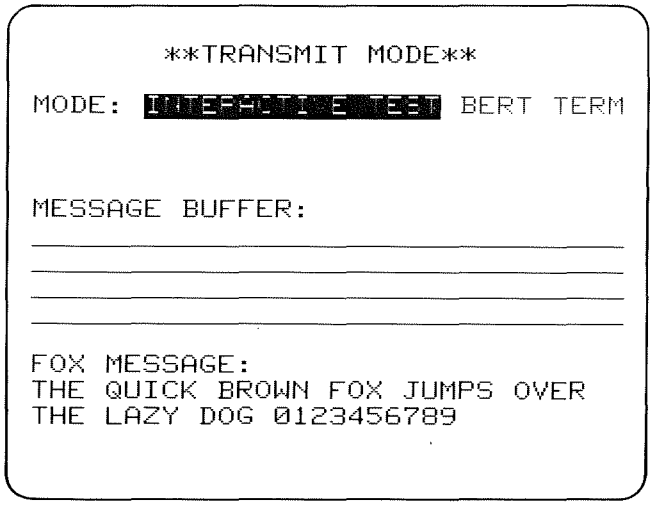


Figure 21-2 Transmit Mode menu.

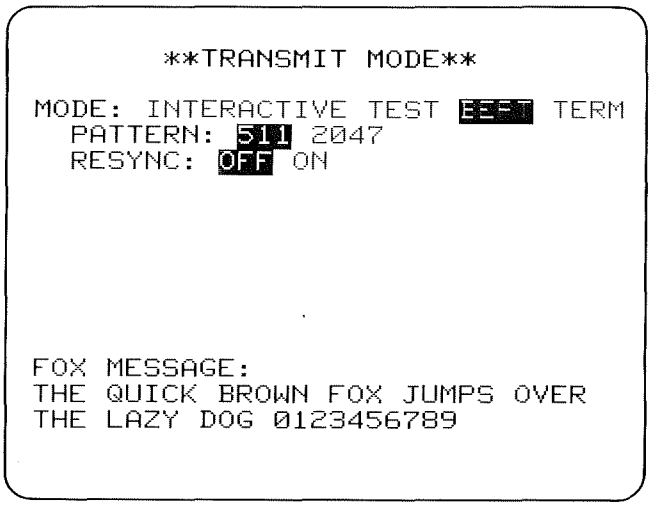


Figure 21-3 Selecting Bit Error Rate Test.

For RS-232/V.24 and for V.35 circuits in TEST DCE mode, the COMSTATE I will drive SCTE. In TEST DTE mode it will drive SCT and SCR. Table 21-4 summarizes clock operation for various RS-232/V.24 and V.35 operating selections.

In X.21 mode, the clock selection on the Protocol Setup menu has no effect. If TEST DTE is selected on the Protocol Setup menu, clock is automatically supplied, with the speed selectable. If TEST DCE is selected, clock is expected from the DCE.

21.3 TRANSMIT MODE SELECTIONS

Once you have selected the Test mode (DTE or DCE), you must select the type of transmission you will use. You have the choice of transmitting messages, transmitting a Bit Error Rate Test, or using the COMSTATE I as an interactive terminal. Make the selection on the Transmit Mode menu (Program 6, Figure 21-2).

(a) Interactive Test Mode. This is the default and most common mode of operation. You can enter a message up to 128 characters long in the message buffer, then select it for transmission on the Interactive Test menu using the BIT MASK MSG key.

(b) Bit Error Rate Test (BERT). Selecting BERT alters the Transmit Mode menu, as shown in Figure 21-3. The Bit Error Rate Test is discussed in detail in Section 27.

(c) Terminal Mode. Selecting TERMinal alters the Transmit Mode menu as shown in Figure 21-4. Terminal mode operation is discussed in detail in Section 28.

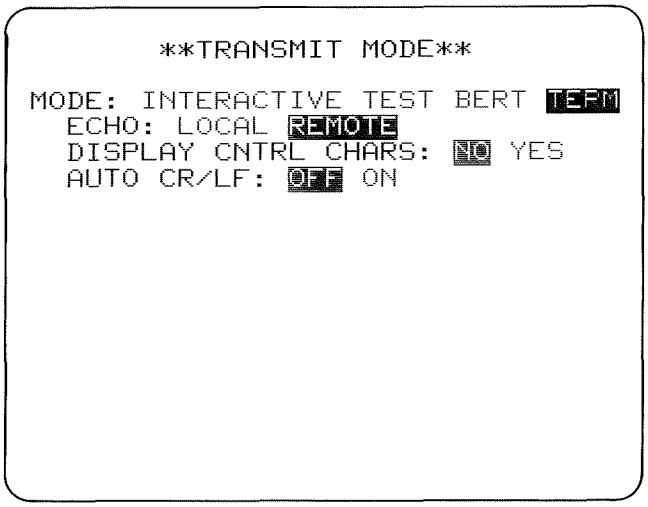


Figure 21-4 Selecting Terminal mode.

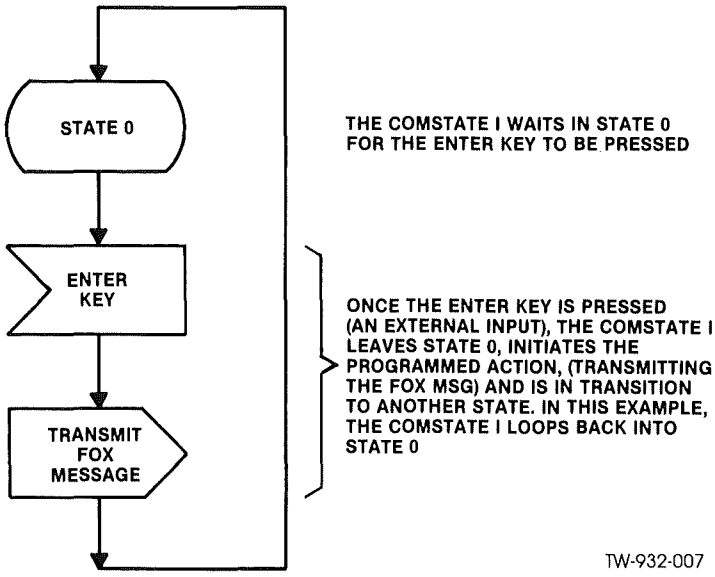


Figure 22-1 A simple state transition.

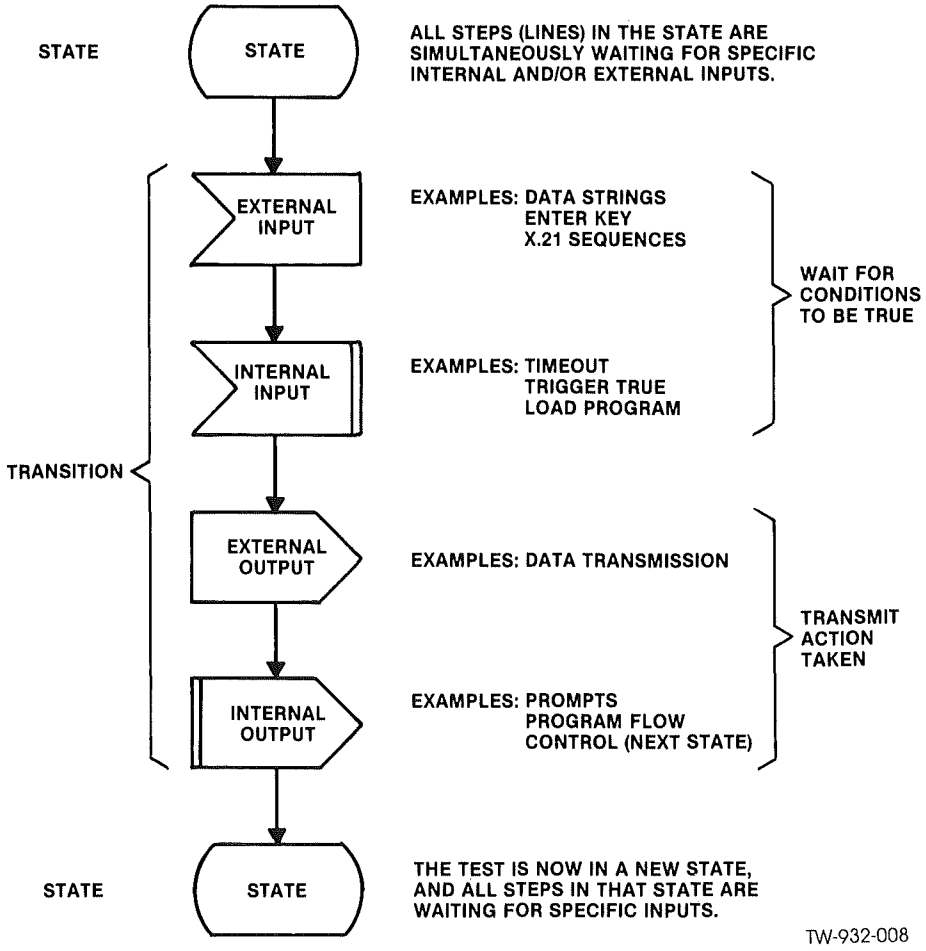


Figure 22-2 Key to symbols used in state diagrams.

22
INTERACTIVE TESTING: STATES AND THE INTERACTIVE TEST MENU

This section introduces the concept of testing using states and gives an overview of the Interactive Test menu.

22.1 WHAT ARE STATES?

The state concept adds a new dimension to data communications testing. Testing on other protocol testers is done in a sequential process, moving from one step in the test to another in a linear manner. With the COMSTATE I you can test for multiple conditions at any one time; that is, the COMSTATE I takes action as soon as any one of a number of specific conditions comes true. This ability to test for Condition A or Condition B or Condition C (up to 32 conditions simultaneously) lets you construct test routines with multiple branches.

Furthermore, with states you are free to move from one test state to any other test state, as required by your particular test. Programming using states is conceptually similar to structured programming: you can develop modular routines which test particular phases (states) of a data communications dialog, and save routines for use at any time.

States may be defined in terms of inputs and outputs: a state is a condition of waiting for particular inputs which, once received, result in particular outputs. In data communications, state refers to the particular phases of a transmission protocol (the Ready state, the Data Transfer state, etc.). In data communications testing, it refers to the particular phase of the test. The test state may correspond exactly to the transmission protocol state, making programming very easy.

Figure 22-1 diagrams a very simple, single-state test involving one input and one output. Notice as soon as the input is received, the test is no longer in State 0, but is in transition to another state (in this example it is in transition back to State 0). Figure 22-2 explains the different symbols used in the state diagrams throughout this manual.

COMSTATE technique gives you programming power far beyond testers that operate sequentially. Consider the following typical situation. In a simple multipoint communications environment, a host sends out regular polls to the various terminals in the network. If a terminal has data to send

to the host, the data is sent only once the terminal receives the host's poll. The terminal then waits for an acknowledgment (ACK) that the data was received by the host. If improper data was received, the host responds with a negative acknowledgment (NAK) and the terminal retransmits the original data. If the terminal does not receive an ACK or a NAK within a specific time, it goes back to waiting for a poll from the host. A simplified diagram of the situation is shown in Figure 22-3.

To emulate a terminal in the situation described by Figure 22-3, a sequentially-programmed tester would have to develop a complicated test to anticipate the three possible reponses from the host. The COMSTATE I, however, can incorporate all three responses in one simple test. The COMSTATE I waits for a poll, responds with data, then waits for the host's response. Figure 22-4 shows the state diagram for such a test. Notice the direct similarity between this state diagram and the block diagram in Figure 22-3. The actual COMSTATE I test for this situation, derived from the state diagram, is shown in Figure 22-5.

A COMSTATE I test moves from one set of circumstances (state) to another, looking for one of numerous conditions, taking particular actions when one of those conditions is met, then branching to other states as the test progresses. There is a similarity between states and triggers in that both wait for certain conditions before taking particular actions. Because it looks for multiple conditions simultaneously, however, the state concept is a more dynamic test method.

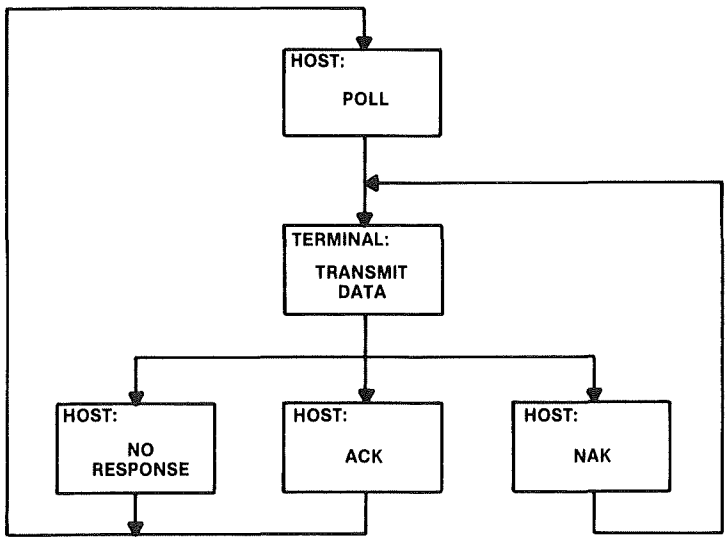


Figure 22-3 Simple test situation: terminal responds to a poll; then waits for the host's response.

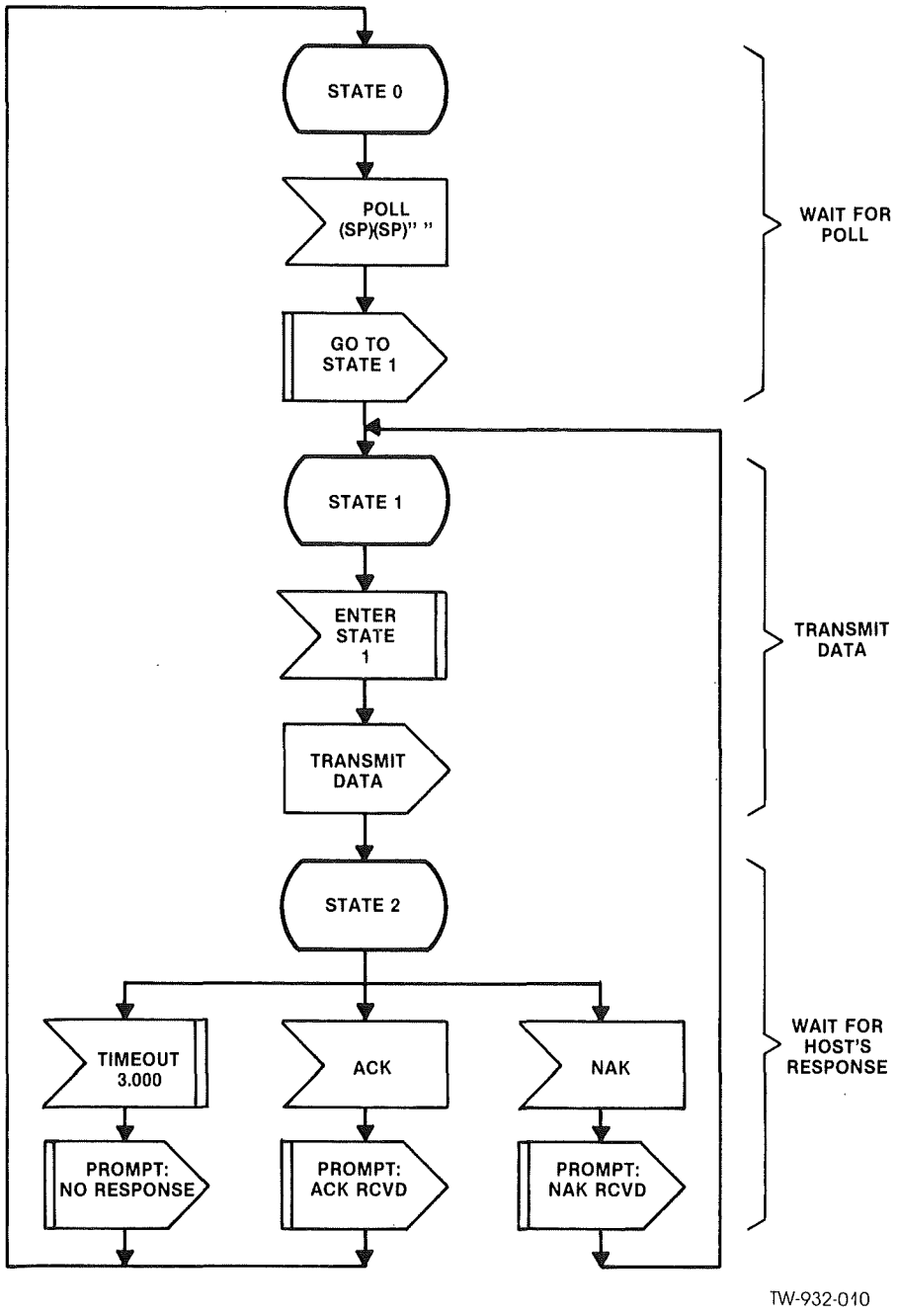


Figure 22-4 State diagram of test.

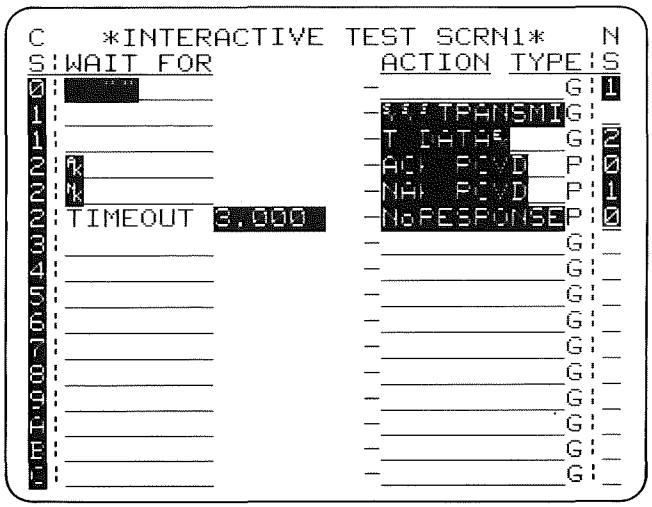


Figure 22-5 The actual test program taken from the state diagram.

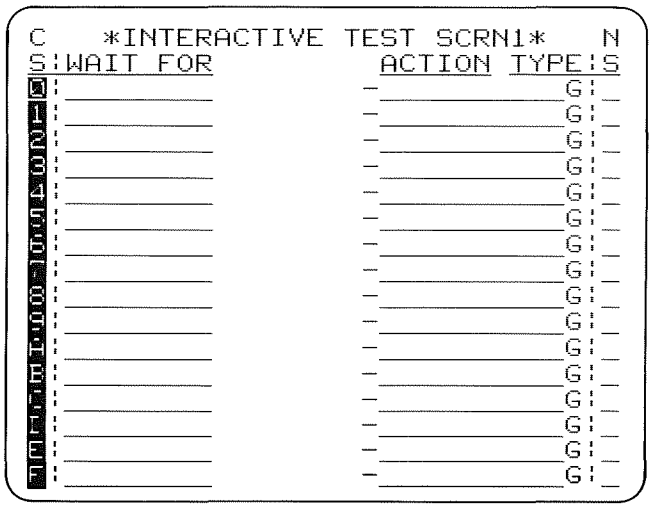


Figure 22-6 Default Interactive Test menu.

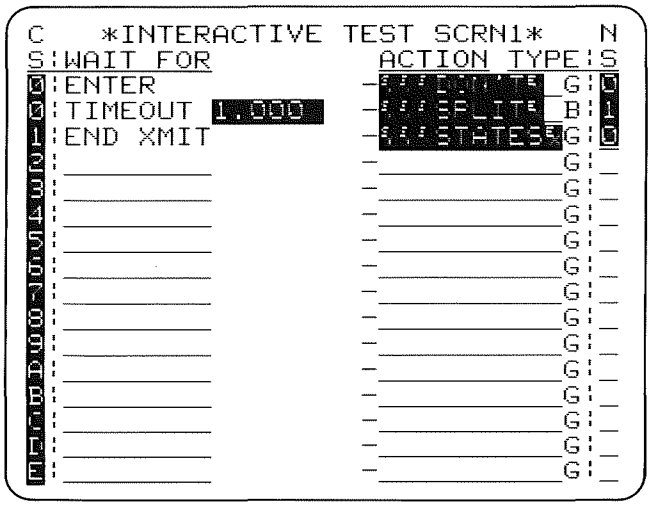


Figure 22-7 A valid interactive test.

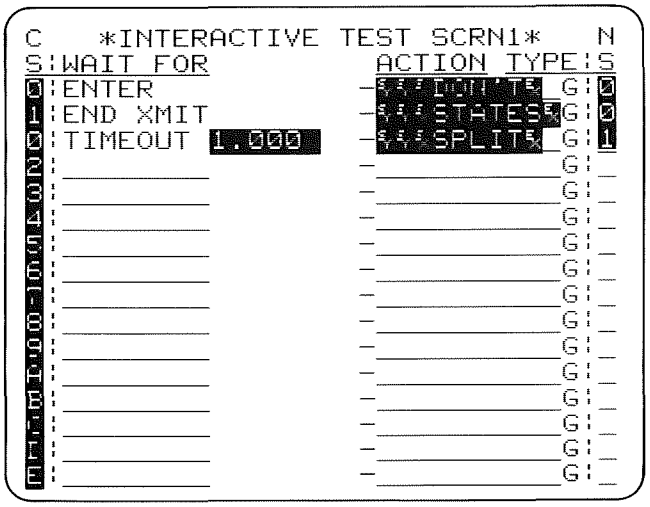


Figure 22-8 Invalid test: steps within a state must be contiguous.

22.2 THE INTERACTIVE TEST MENU

COMSTATE I interactive tests are programmed on the Interactive Test menu shown in Figure 22-6 (Program 7). This menu is divided into two screens: screen one and screen two. You may go from one screen to the other by pressing CONTROL-ENTER.

The Interactive Test menu itself is divided into five columns or fields. They are, from left to right, the Current State (CS) field, the WAIT FOR field, the ACTION field, the BCC TYPE field, and the Next State (NS) field. Each line on the menu represents a different test step; between the two screens there are 32 available steps. Each of these steps may be assigned to different states, or they may all be in the same state.

To move the cursor from field to field, use the ENTER key. To move back one field, use the LEFT cursor arrow key. To move up and down the menu, use the cursor UP and DOWN keys.

You may insert a line in the menu by pressing CONTROL-DOWN or SHIFT-DOWN. This creates a new line at the current cursor position, and moves the rest of the test down one line. If you try to insert a line when a test already resides on the last line of the menu (on Screen Two), the COMSTATE I will not allow the command. To delete a line in the menu, press CONTROL-UP or SHIFT-UP. This deletes the line at the current cursor position.

To insert a character at the cursor position, press CTRL-RIGHT ARROW or SHIFT-RIGHT ARROW. To delete a character at the cursor, press CTRL(SHIFT)-LEFT ARROW. Repeat this keystroke to delete half a line, for example.

(a) Current State. In this field you identify the test state in which the step is to operate. Valid entries are from 0 (zero) through V, inclusive (for a total of 32 possible states). If no state is specified, the unit assumes the current line will operate in the same state as the previous line. The states need not be entered sequentially on the menu, but all steps in a particular state must be contiguous. For example, the step sequence in Figure 22-7 is valid, the one in Figure 22-8 is invalid.

(b) WAIT FOR. This is a rolling window field in which you select the criteria for the test. The selections in this field are discussed in detail in Section 23. If you leave this field blank, the COMSTATE I will act on the ACTION and Next State specifications immediately upon entering the Current State.

(c) ACTION. In this field you enter any messages you may wish to transmit. Formatting and transmitting messages are discussed in Section 24. If the ACTION field is left blank, no message will be transmitted, and the test will move on to the next designated state.

(d) BCC Type. This field specifies the type of Block Check Character to be transmitted with the message. Alternatively, you may choose not to transmit the message, but display it as a prompt. All these selections are discussed in Section 24.

(e) Next State. In this field you identify the test state to which the test will move. Valid entries are from 0 (zero) through V, inclusive, and there is no incorrect order of entry. Another valid entry, for this field only, is the asterisk (*). The asterisk returns the test to the state from which it came.

If you leave the Next State field blank, the test stays in the current state. If you enter the Current State number in the Next State field, the test reenters that state. Thus, if a timeout was used as a WAIT FOR, it would be restarted only if the Current State number was repeated in the Next State field. When you do define a next state, be sure to enter a step on some other line of the menu for that new state. Otherwise the COMSTATE I will display an error when it is placed in Run mode.

23 INTERACTIVE TESTING: "WAIT FOR" SELECTIONS

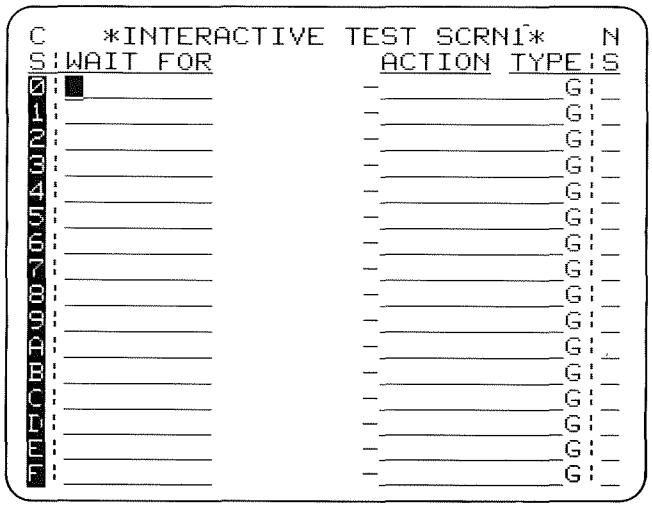


Figure 23-1 The STRING selection is the blank line in the Wait For field.

23
INTERACTIVE TESTING: ''WAIT FOR'' SELECTIONS

The COMSTATE I's Interactive Test menu has seven standard "Wait For" conditions. When any Wait For condition is specified, the COMSTATE I will wait for that condition to come true before taking the actions specified in the Action and Next State fields. These seven standard Wait For conditions are detailed in Sections 23.1 through 23.7.

The COMSTATE I can also perform six X.21-related call sequences. The completion of any of these sequences may be selected as a Wait For condition only when X.21 operation has been specified on the X.21 Protocol Control menu (see Section 25). The X.21 Wait For conditions are discussed in Sections 23.8 through 23.13, and occur in the menu between LOAD and END.

Access the various Wait For conditions by placing the cursor in the Wait For field, then pressing the ROLL key. SHIFT-ROLL or CONTROL-ROLL displays the previous selection.

23.1 STRING

STRING is the default Wait For selection, identified by a blank line as shown in Figure 23-1. You may enter on this line any eight characters from the following list:

- Upper- and lower-case alphanumeric characters.
- Control character mnemonics.
- Two-digit hexadecimal entries.
- 7E flags (use FLAG FOX key).
- Not Equal characters.
- Don't Care characters.
- One Bit Mask (use BIT MASK MSG key).

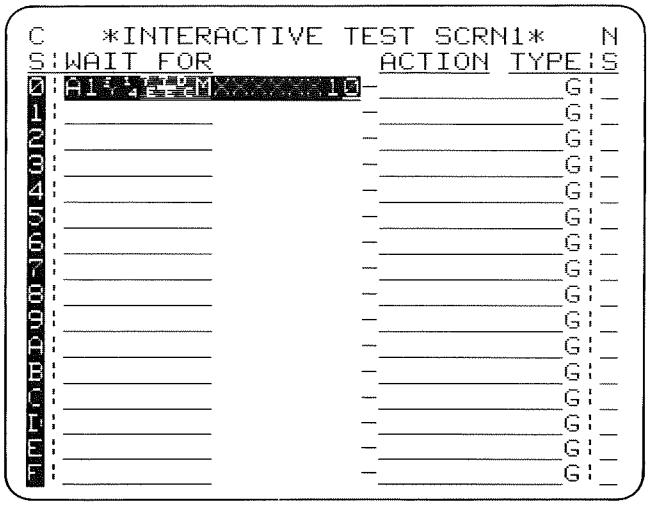


Figure 23-2 A variety of string selections are possible.

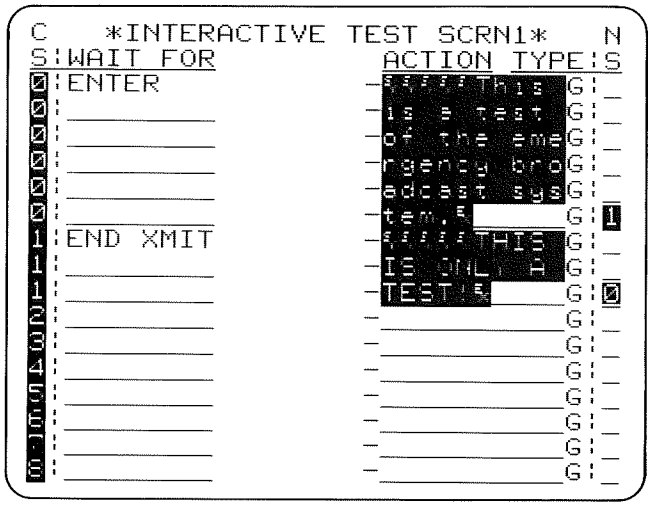


Figure 23-3 Leaving the Wait For field blank lets you concatenate transmissions.

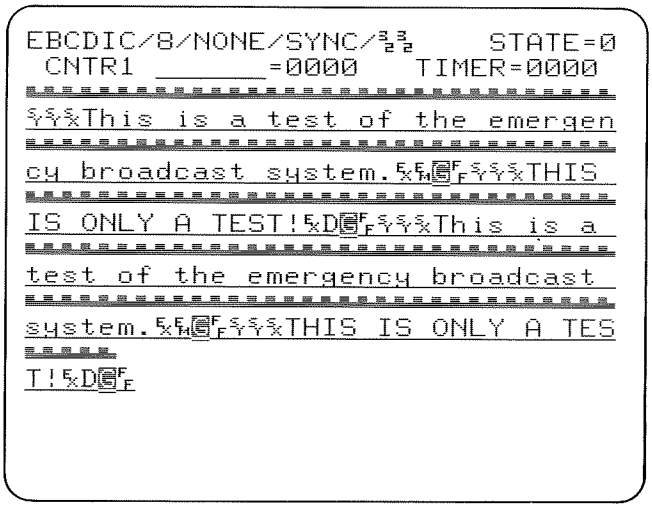


Figure 23-4 The result of the test program in Figure 23-3.

Figure 23-2 shows examples of these string characters. As on other menus, characters that represent something other than themselves -- flags, bit mask, Don't Care characters -- are displayed in low-intensity, reverse image; characters Not Equal to a character are indicated by a bar through the character.

NOTE: The COMSTATE I will not look for WAIT FOR data on the same side of the interface it is controlling: if it is in TEST DTE Mode, it will only monitor TD (T in X.21); if it is in TEST DCE Mode, it will monitor RD (R in X.21). To look at data in the COMSTATE I's own transmissions, use a trigger as the WAIT FOR condition (see Section 23.7), and make the trigger look for the COMSTATE I's transmissions.

NOTE: If you have two or more steps in a single state, and the WAIT FOR line on one of the steps is blank, the contents of the blank line's ACTION field will be appended to the previous message text without interface handshaking or 7E insertion. This concatenation lets you create messages longer than 10 characters without using the Message Buffer (Program 6). The test shown in Figure 23-3 results in the transmission shown in Figure 23-4. All BCC selections should be the same (all GD, all BD, or all NO) for all concatenated transmissions, and no other test steps should be inserted between concatenated strings.

23.2 ENTER

When ENTER is selected, the test logic looks for the ENTER key to be pressed. This effectively gives you manual control over the transmission program. In Figure 23-3, for example, the first transmission (State 0) will not be sent until the ENTER key is pressed.

23.3 END XMIT

END XMIT waits until the COMSTATE I has completed transmitting a message before initiating the next action. If the next action is also a transmission, handshaking is performed between the transmissions.

CAUTION: The COMSTATE I does not differentiate between transmissions; it acts upon the first end of transmission it sees. Furthermore, the transition between states is instantaneous whereas transmission times vary with data speeds and message lengths. Therefore, it is possible the COMSTATE I will react to the end of a transmission from a previous state, rather than the transmission you intended.

23.4 LOAD

The LOAD selection automatically loads a test program or setup from the Test Library. This very powerful feature lets you automatically change tests and setups at any time in the test sequence, when you enter a particular state, for instance.

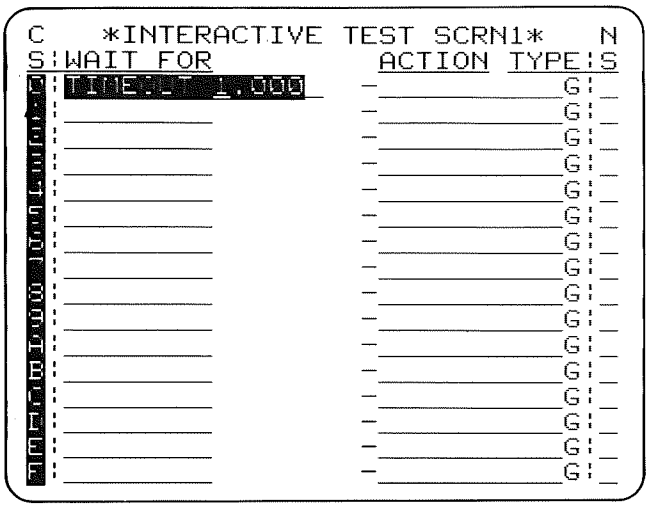


Figure 23-5 The TIMEOUT selection.

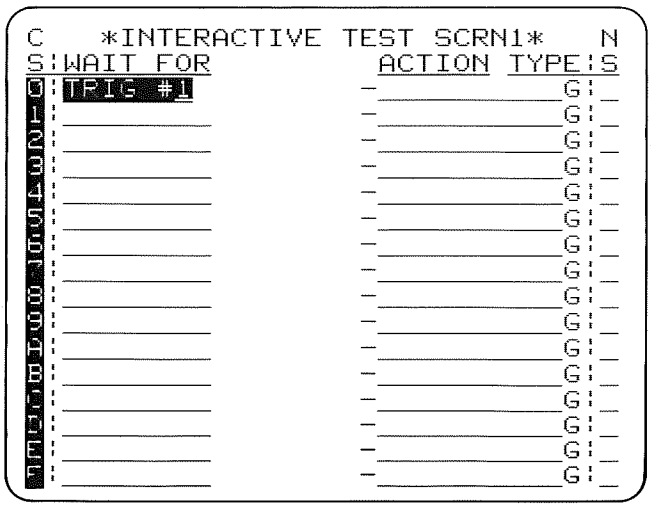


Figure 23-6 The TRIGGER selection.

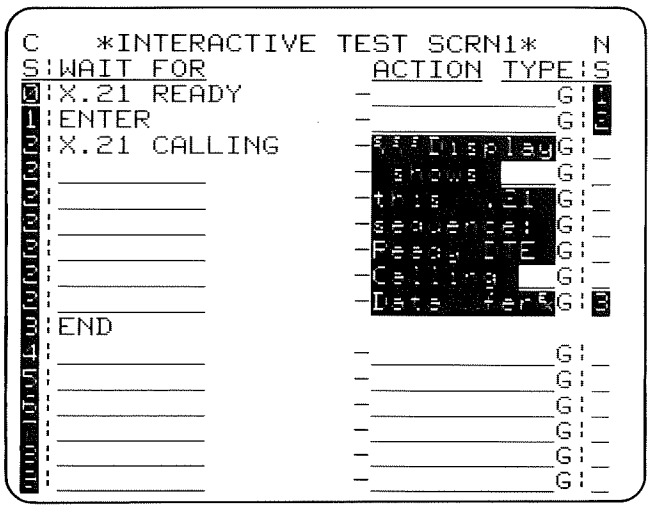


Figure 23-7 Test DCE, DTE Calling.

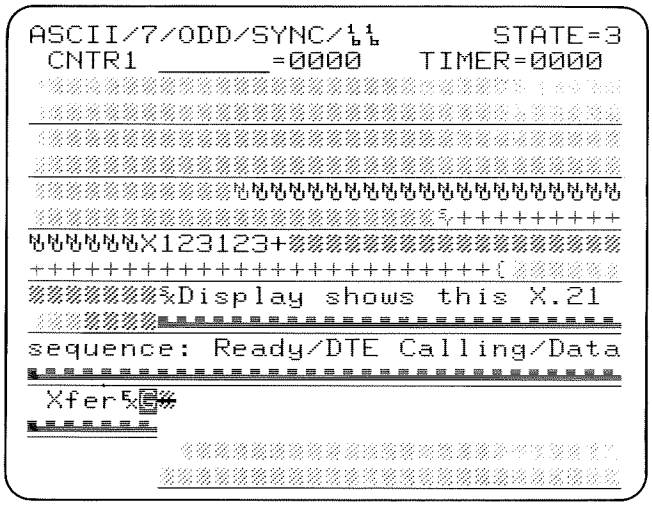


Figure 23-8 Ready, DTE Calling, Data Transfer.

The programs are identified by a 3-digit ID number. This ID number is comprised of the Slot and Record designations used in the Test Library menu (see Section 29.3). The first digit of the 3-digit ID number corresponds to the Slot number. The second and third digits are the Record number.

23.5 END

When the test program reaches END, the COMSTATE I will not send any more transmissions even if their WAIT FOR conditions have just come true. END is useful for debugging tests section by section.

23.6 TIMEOUT

The TIMEOUT selection with the timeout timer is shown in Figure 23-5. Enter the desired value for the timeout timer (in seconds, between 0.001 and 65.53 -- values outside this range will revert to 65.53 seconds).

The COMSTATE I's timeout timer is controlled by both the Interactive Test menu and the triggers. The timer resets when the test enters a state where TIMEOUT has been selected. The timeout then becomes the condition for the next action.

If there is more than one TIMEOUT condition within a single state, the last TIMEOUT will override all other TIMEOUT values. If a state has a TIMEOUT condition, and a trigger has a TIMEOUT RESTRT action, and the trigger comes true at exactly the moment that the state is entered, the state TIMEOUT takes precedence.

23.7 TRIGGER

You may use the conditions from one of the COMSTATE I's triggers as a condition for transmission. When the trigger is true, the next transmission will be sent. The default trigger is #1 (as in Step 1 of Figure 23-6). You may select another trigger by writing over the trigger number.

If Actions are set on a trigger that is also being used as a WAIT FOR condition, then all actions on that trigger will be taken before the test ACTION is taken.

23.8 X.21 CALLING

If X.21 CALLING is selected, the COMSTATE I executes one side of the standard X.21 Calling sequence. In Figure 23-7, the COMSTATE I is emulating a DTE, testing a DCE at a switching site (TSTSWTCH on the Program C menu).

When the unit enters Run mode, the test is in "X.21 Ready" state, idling low-intensity FF pads. See the top two dual-display lines in Figure 23-8. (Low-intensity pad characters and NULLs indicate that the control lead is turned OFF. See the display key in Figure 25-2.) When the operator presses ENTER, the unit initiates the calling sequence. When Ready for Data state (1, ON, 1, ON) is reached, the trigger comes "true" and the transmitters send a message.

If the unit is testing a user-site DTE or DCE, it waits for a Call Request before responding with a Proceed to Select, then moves on through the sequence to the Data Transfer state.

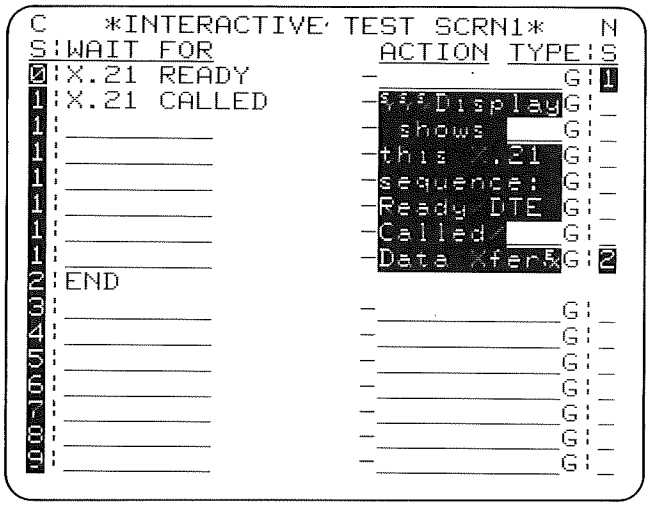


Figure 23-9 Test DCE, DTE Called.

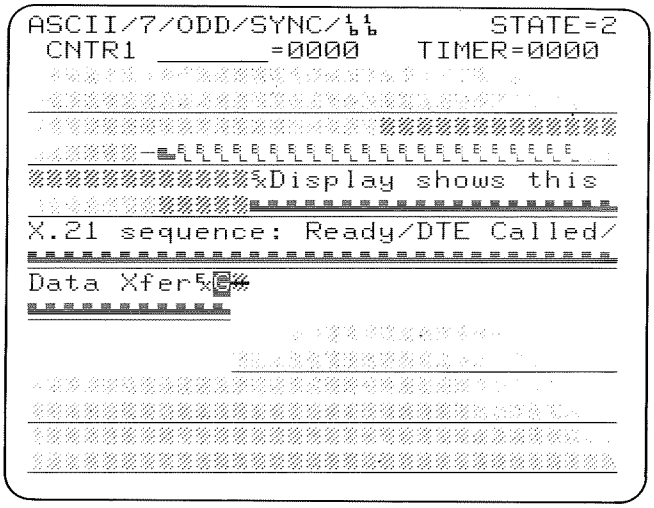


Figure 23-10 Ready, DTE Called, Data Transfer.

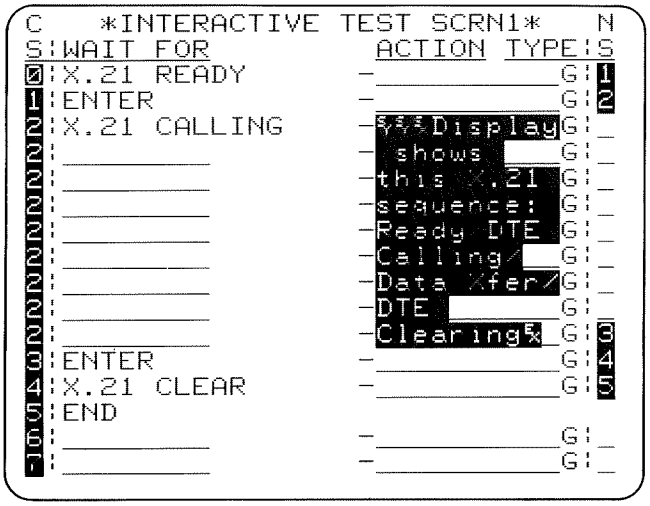


Figure 23-11 Test DCE, DTE Clearing.

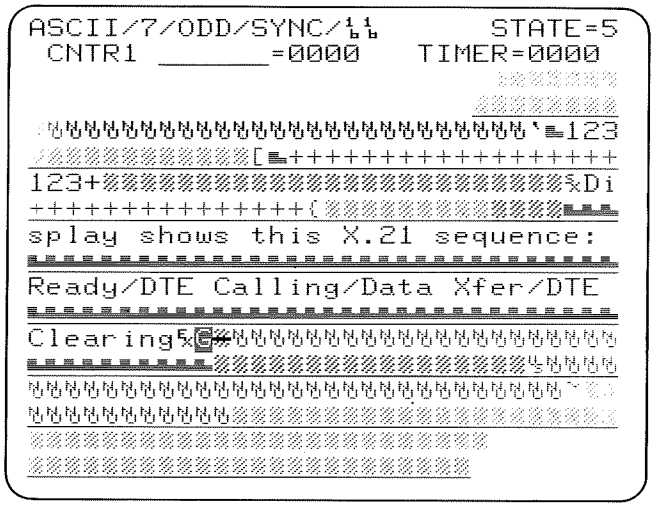


Figure 23-12 Ready, DTE Calling, Data Transfer, DTE Clearing.

NOTE: In the X.21 literature, the DTE always is associated with the user site, and the DCE with the switching site. DTE Calling means that a user-site DTE is calling. More accurately, it means that a user site is doing the calling, since there are both DTE and DCE at each site. It clears up confusion to think of the Calling state, not as DTE Calling, but as User Site Calling. Suppose, for example, you are emulating a DTE at the network site (or switching site). You want to initiate a call. Since you are a DTE, select TEST DCE on the Program 0 menu. Since the user site is being called by you, select X.21 CALLED on the Interactive Test screen. And since you are at the switching site, select TSTUSR on the Program C screen.

See Figures 23-15 and 23-16 for state diagrams of the DTE Calling sequence.

23.9 X.21 CALLED

When X.21 CALLED is selected, the COMSTATE I executes one side of the standard X.21 Called sequence. In Figures 23-9 and 23-10, the COMSTATE I is emulating a DTE, testing a DCE at a switching site (TSTSWTCH).

The COMSTATE I goes from the X.21 Ready state to the Call Accepted state once it receives an Incoming Call signal (the string of BELL characters in Figure 23-10). Once Ready for Data state (1, ON, 1, ON) is reached, the "X.21 Called" condition comes true and the test in Figure 23-9 transmits a message.

If the COMSTATE I is testing a user-site DTE or DCE, the unit initiates the Incoming Call state and moves on through to the Data Transfer state.

NOTE: In the X.21 literature, the DTE always is associated with the user site, and the DCE with the switching site. DTE Called means that a user-site DTE is being called. More accurately, it means that a user site is being called, since there are both DTE and DCE at each site. It clears up confusion to think of the Called state, not as DTE Called, but as User Site Called. Suppose, for example, you are emulating a DTE at the network site (or switching site). You want to answer a call. Since you are a DTE, select TEST DCE on the Program 0 menu. Since the user site is calling you, select X.21 CALLING on the Program 7 screen. And since you are at the switching site, select TSTUSR on the Program C screen.

See Figures 23-17 and 23-18 for state diagrams of the X.21 Called sequence.

23.10 X.21 CLEAR

If X.21 CLEAR is selected, the COMSTATE I executes one side of the standard X.21 clearing sequence. In Figures 23-11 and 23-12, the COMSTATE I is emulating a DTE, testing a DCE at a switching site (TSTSWTCH on the Program C menu). The COMSTATE I initiates a Clear Request, then waits for the Clear Confirmation (NULLs, with the control lead OFF) before returning to the X.21 Ready state.

If the COMSTATE I is testing a DTE or a DCE at a user site, the sequence is the same: the unit initiates a Clear Indication, waits for the Clear Confirmation, sends a Ready signal and returns to the Ready state.

See Figures 23-15 through 23-20 for state diagrams of the X.21 DTE Clearing and Cleared sequences.

23.11 X.21 READY

When X.21 READY is selected, the COMSTATE I enters the X.21 Ready state. This WAIT FOR condition is true immediately. To hold the test in this state, follow this WAIT FOR selection with a TIMEOUT entry.

23.12 X.21 NOT READY

When X.21 NOT READY is selected, the COMSTATE I enters the X.21 Not Ready state by transmitting, if it is testing a DCE, T=0, C=off; or, if it is testing a DTE, R=0, I=off. These will appear as low-intensity NULLs on the COMSTATE I data display. Once this transmission is initiated, the unit moves on to transmit a message or move on to another test state.

23.13 X.21 SELECTIVE DIRECT CALL

If X.21 SELECTIVE DIRECT CALL is chosen, the COMSTATE I executes one side of the standard X.21 Calling sequence, with the Selective Direct Call signal inserted in X.21 State 4 (see Figure 23-15). The Selective Direct Call signal may be specified on the X.21 Interface Control (Program C) menu.

In Figures 23-13 and 23-14, the COMSTATE I is emulating a DTE, testing a DCE at a switching site. The Selective Direct Call signal is represented by the string of 3's in Figure 23-14. (Compare this figure with Figure 23-8.)

If the COMSTATE I is testing a user-site DTE or DCE, the unit waits for a Call Request before responding with a Proceed to Select, then moves on through the sequence to the Data Transfer state.

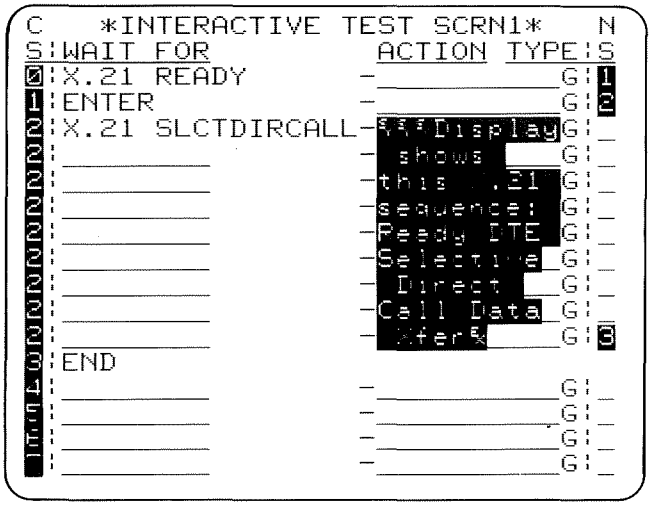


Figure 23-13 Test DCE, Selective Direct Call.

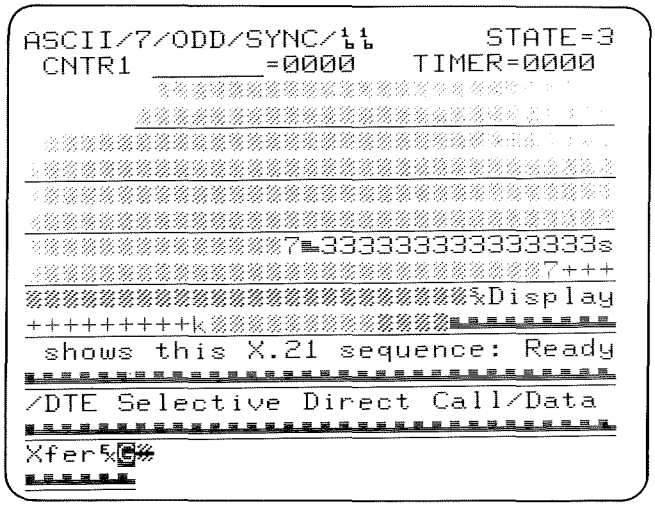


Figure 23-14 Ready, DTE Selective Direct Call, Data Transfer.

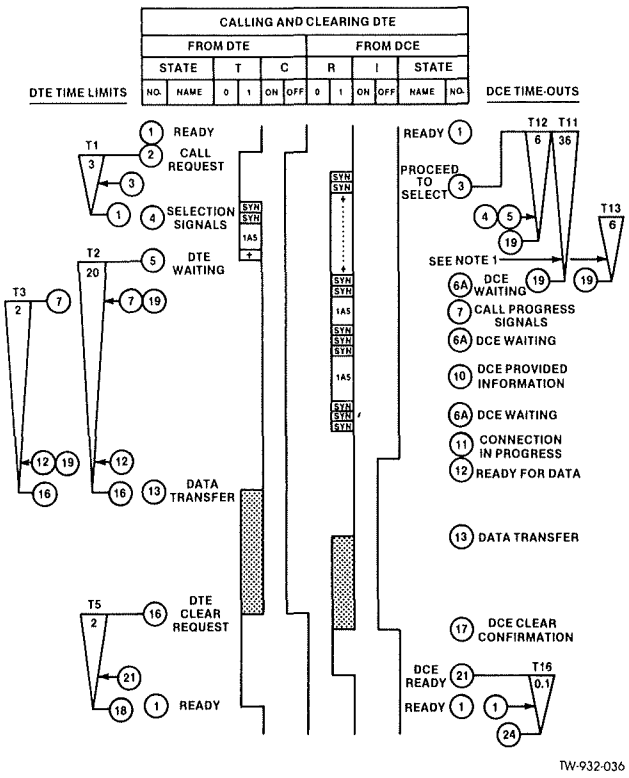


Figure 23-15 X.21 DTE Calling and Clearing diagram.

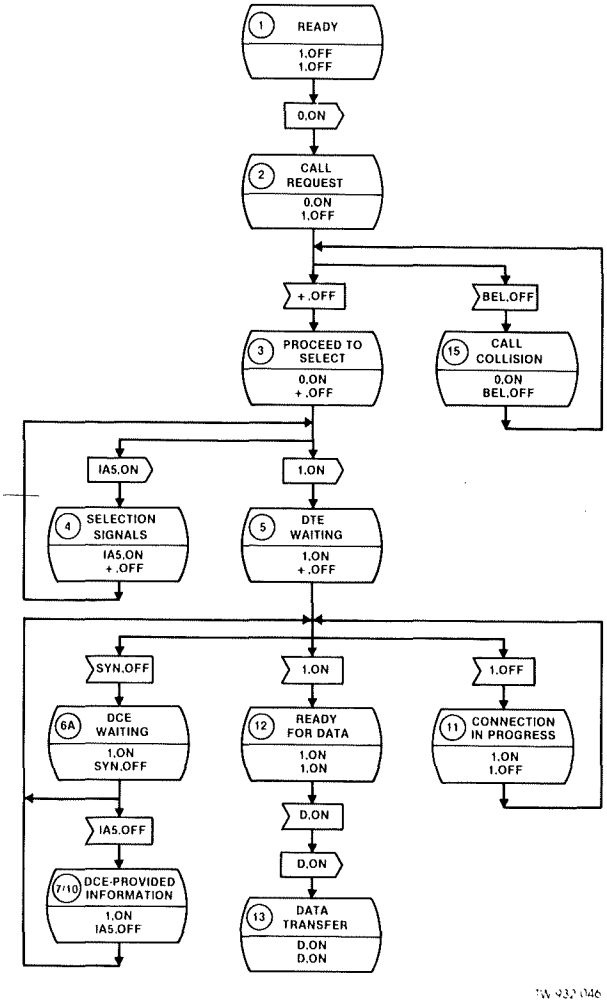


Figure 23-16 X.21 DTE Calling state diagram.

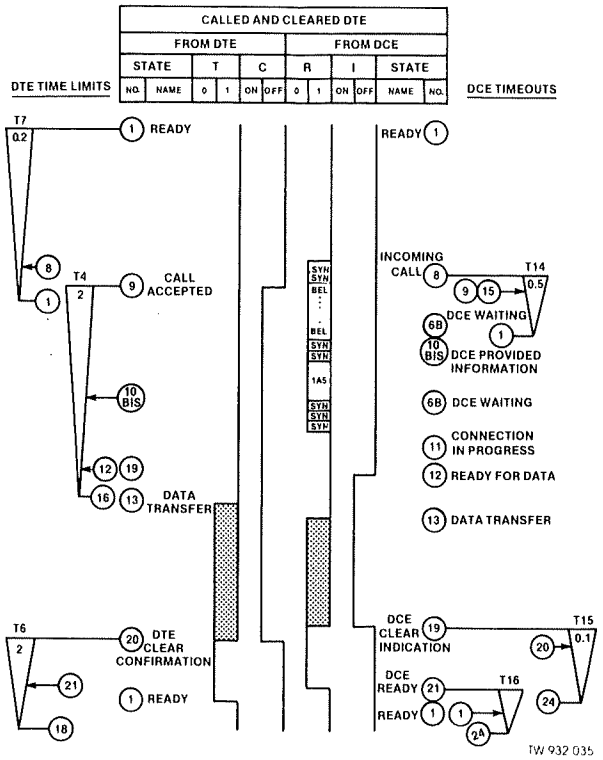


Figure 23-17 X.21 DTE Called and Cleared diagram.

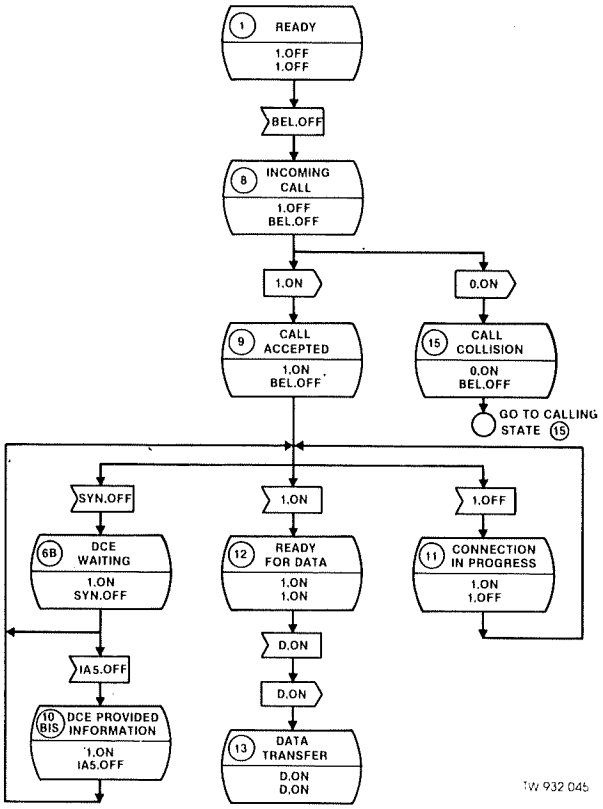


Figure 23-18 X.21 DTE Called state diagram.

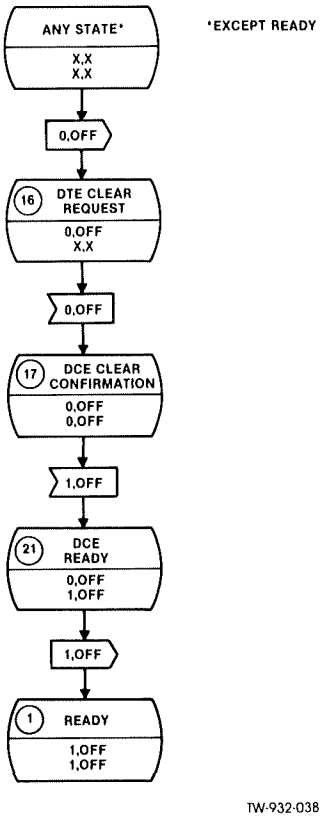


Figure 23-19 X.21 DTE Clearing state diagram.

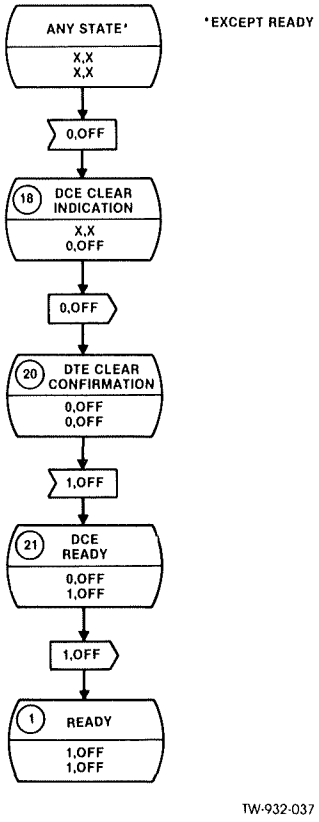


Figure 23-20 X.21 DTE Cleared state diagram.

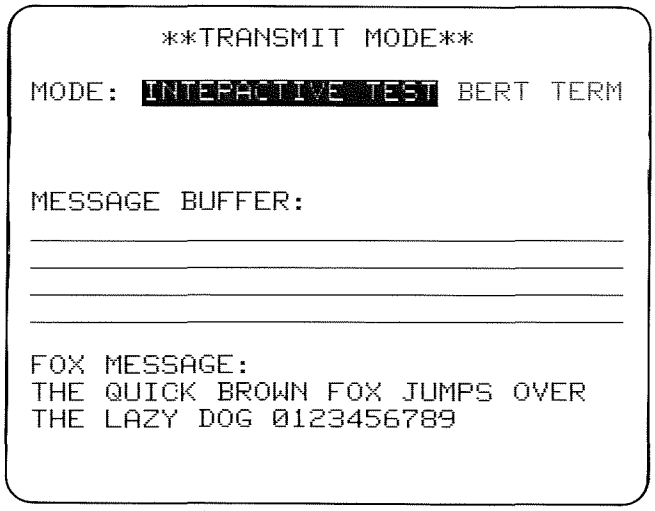


Figure 24-1 Transmit Mode menu defaults to INTERACTIVE TEST.

24
INTERACTIVE TESTING: TRANSMITTING MESSAGES

Once you are familiar with the Wait For selections (in Section 23), transmitting messages interactively with the COMSTATE I is simple. Short messages of up to ten characters may be entered and sent directly from the Interactive Test menu. Longer messages may be entered in the Message Buffer on the Transmit Mode menu, and accessed in the ACTION field using the BIT MASK MSG key. A standard "Fox" message is available in the COMSTATE I, giving you access to a 54 character message using the FLAG FOX key.

A message can be transmitted with a good Block Check Calculation, a bad BCC, no BCC, or, in Bit Oriented Protocols, an Abort. The type of BCC is selected in the Type field on the Interactive Test menu. Also in the Type field, you may select that a message not be transmitted, but displayed as a prompt instead.

Select TEST DTE or TEST DCE on the Protocol Setup menu to prepare the COMSTATE I for an interactive test. To enter a message in the Message Buffer, press PROGRAM, 6. This will call up the Transmit Mode menu.

24.1 ENTERING MESSAGES ON THE TRANSMIT MODE MENU

The Transmit Mode menu defaults to Interactive Test mode, and the message buffer is displayed (see Figure 24-1).

On the four Message Buffer data-entry lines, you can enter up to 128 characters. Valid characters are all alphanumeric, control, and hexadecimal characters. Special keys such as the FLAG FOX and BIT MASK MSG keys are illegal. Use the ENTER key to move the cursor from one data-entry line to the next, and the UP arrow to return to the previous line.

To transmit the message in the Message Buffer, use the BIT MASK MSG key in the ACTION field of the Interactive Test menu. The entire Message Buffer will be sent in lieu of the low-intensity reverse-image "M" displayed in the ACTION field.

24.2 FOX MESSAGE

To send the Fox Message, use the FLAG FOX key in the ACTION field of the Interactive Test menu. This will enter a low-intensity reverse-image letter "F" to represent the Fox Message in the field. The characters actually sent in the Fox Message will vary according to the code selected on the Protocol Setup menu:

Unshifted codes, 54 characters:

THE QUICK BROWN FOX JUMPS
OVER THE LAZY DOG 0123456789

Upper/lower case shifted codes, 56 characters:

^THE QUICK BROWN FOX JUMPS
OVER THE LAZY DOG\ 0123456789

Letters/figures shifted codes, 56 characters:

\THE QUICK BROWN FOX JUMPS
OVER THE LAZY DOG^ 0123456789

24.3 ENTERING MESSAGES ON THE INTERACTIVE TEST MENU

Up to ten alphanumeric, control, or hexadecimal characters may be entered in the ACTION field of the Interactive Test menu. Figure 24-2 shows these various types of characters, along with the low-intensity designations for the Fox message and the Message Buffer. Enter the Fox message by pressing the FLAG FOX key, and the Message Buffer by pressing the BIT MASK MSG key.

NOTE: In the WAIT FOR field, low-intensity, reverse-image "F" means a 7E Flag, while in the ACTION field it means the Fox message. Similarly, in the WAIT FOR field, a low-intensity, reverse-image "M" means a Bit Mask, while in the ACTION fields it designates the Message Buffer.

Notice that synchronization characters, headers, and other protocol can all be entered in the ACTION fields.

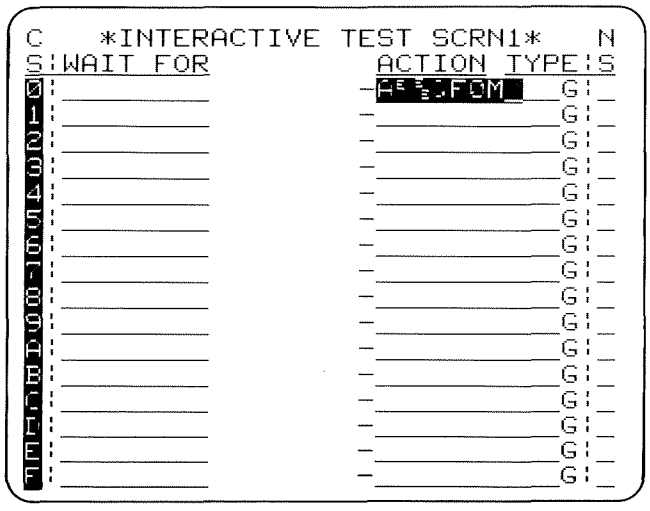


Figure 24-2 Valid entries in the Action field.

24.4 BLOCK CHECK TRANSMISSIONS

Select the type of block check character you wish to send with your transmission in the TYPE field on the Interactive Test menu. There are four possible selections (G, B, N, and P), each accessed by the ROLL key.

If you select "G", the COMSTATE I will calculate and send the correct block check character for the code and format selected on the Protocol Setup menu and the BCC Parameters menu. See Section 9 for details on the actual block check calculations. One ACTION field is always treated as one block.

If you select "B" (Bad), the COMSTATE I will calculate the correct block check character and invert it for a bad BCC.

In other than bit-oriented protocols, you may send a BCC of your own choosing. Simply select "N" (No) in the TYPE field, and enter any final character(s) you choose in the ACTION field. For BOP and BOP/NRZI, selecting "N" will interrupt the transmission with an Abort.

Finally, you can use the ACTION field to display a prompt during the test, rather than send a transmission. Selecting "P" (Prompt) in the TYPE field displays whatever you have entered in the ACTION field as a prompt on line 1. If you have entered a Fox message or the Message Buffer in the ACTION field, they will be displayed simply as an "F" or an "M" on the Prompt line.

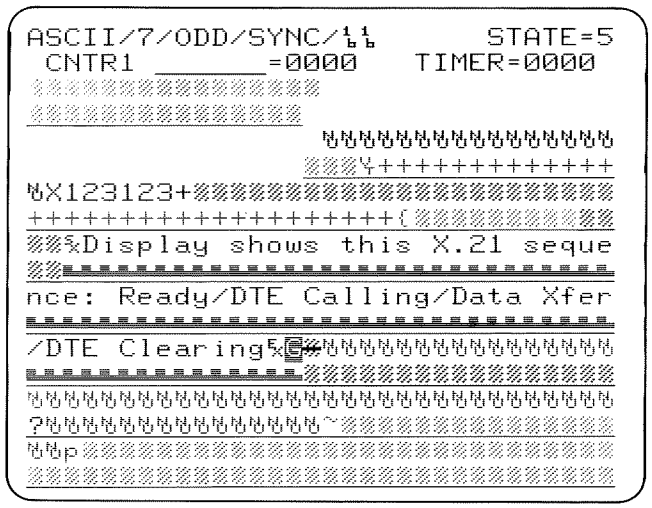


Figure 25-1 X.21 DTE Calling sequence.

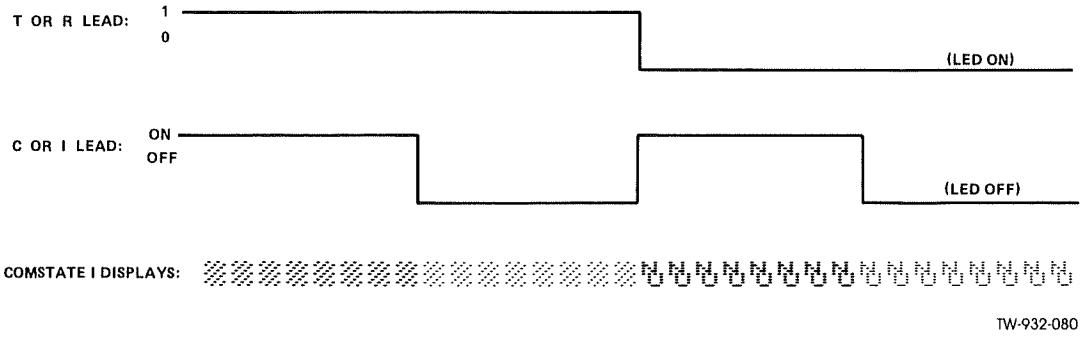


Figure 25-2 COMSTATE I display during the four possible combinations of the control and data leads in steady state.

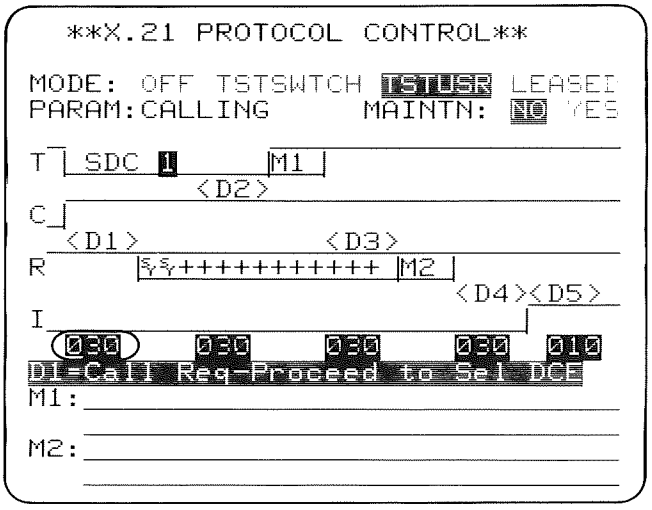


Figure 25-3 Selecting X.21 TSTUSR mode.

25
X.21 OPERATION: SETUP AND INTERFACE CONTROL

The X.21 Protocol Control menu (Program C) performs a variety of functions in setting up an interactive X.21 test:

- Selects X.21 switched-circuit operation (either Test Switching Site or Test User Site) or Leased operation.
- Defines Selective Direct Call numbers, Selection Signals, and DCE-provided information.
- Controls the delay times in eight X.21 states.
- Controls the timeout values for thirteen standard X.21 transitions.
- Turns X.21 operation off (COMSTATE I reverts to RS-232/V.24/V.35 mode).

To operate in X.21, first make the selection for CONNECTOR: X.21 on the PROGRAM 0 menu. (RS232 is appropriate for X.21bis.) Then select TSTSWTCH, TSTUSR, or LEASED on the Program C menu. The COMSTATE I is now ready to monitor X.21 data. If you are constructing an interactive test, you must make further selections on the Program 7 menu (see Sections 23.8 through 23.13) and on the Program C menu.

Except in Data Transfer state, where you can program the unit to suppress idle characters (Program 0 menu), the COMSTATE I displays on its screen the status of all four control (C, I) and data (T, R) leads at all times. This means that during a call or a clear sequence, you can observe every change in state on the data display, without relying on the lead-indicator lights on the front panel. Figure 25-1 shows a typical calling and clearing sequence.

The diagram in Figure 25-2 shows the COMSTATE I display during the four possible combinations of the control and data leads in steady state. Note that when the control lead goes off, the display changes to low intensity. Use this diagram to correlate the various timing diagrams on the Program C menu with the COMSTATE I's data display.

25.1 TSTSWTCH AND TSTUSR OPERATION

The X.21 Protocol Control menu defaults to the OFF position, for RS-232/V.24/V.35 operation. Select TeSTSWiTCH OR TeSTUSeR mode for switched-circuit X.21 operation, or LEASED mode for X.21 operation over a leased line. The TSTUSR mode selection is shown in Figure 25-3.

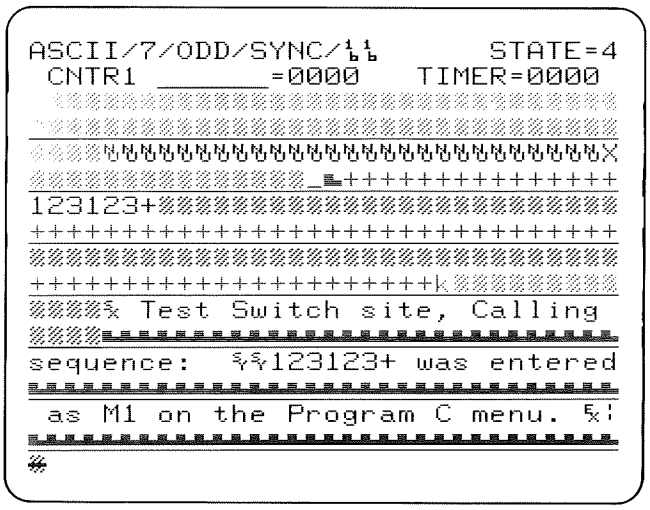


Figure 25-4 M1 is the user site's Selection signal.

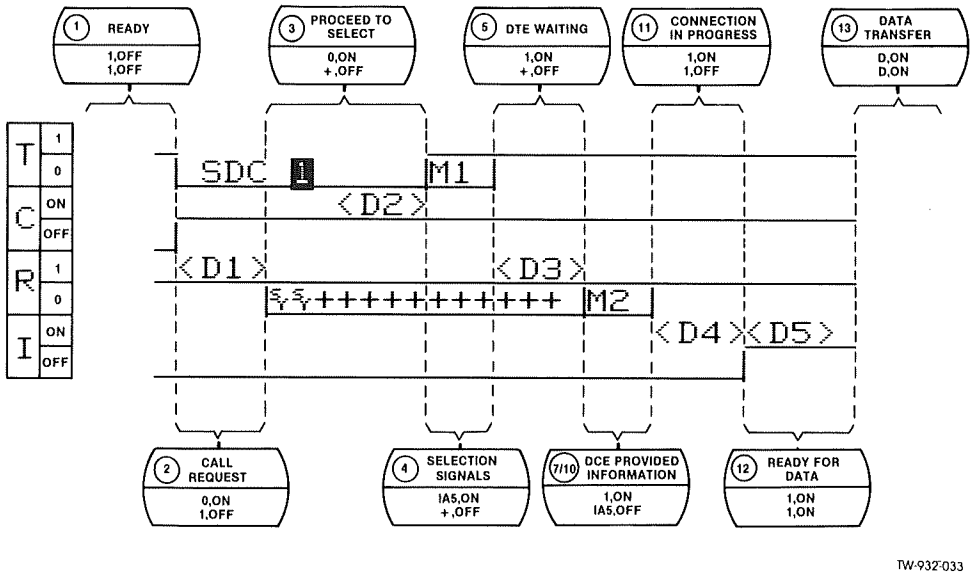


Figure 25-5 X.21 Calling sequence display broken into states.

If you are a DTE at one site, then you are testing the other site. For example, if you are a DTE at a user site (with TEST DCE selected on Program 0), select TSTSWTCH.

If you are a DCE at one site, then you are testing the same site. For example, if you are a DCE at a user site (with TEST DTE selected on Program 0), select TSTUSR. See Figure 25-8.

There are five basic sets of timing parameters that you control both in TSTSWTCH and TSTUSR modes. These are delay times for eight major X.21 functions, and the timeout limits for thirteen basic state transitions. Each of these five basic parameters has a different display, and is accessed from the PARAMeter window by the ROLL key.

NOTE: Any value you enter in a Protocol Control menu time field is assumed to be in milliseconds. You can designate seconds by typing an "S" after the value, or using a decimal point (for example, "6S" or "6.0" for six seconds). The largest valid entry is 65 seconds; any entry larger than "65s" will only run for 65 seconds.

The parameters are always named from the user site's point of view. CALLING, for example, means User Site Calling. When the call originates with the network, the parameter is CALLED.

NOTE: In the X.21 literature, Calling usually is interpreted as DTE Calling, while Called is understood as DTE Called. This is misleading, since there are both DTE and DCE at either site. Suppose, for example, you are a DTE at a switching site and you want to originate a call. You are a DTE and you are calling, but the standard nomenclature would designate this as DTE Called. It is less confusing to think of it as User Site Called, and to interpret Calling, Called, Clearing, and Cleared always from the standpoint of the user site.

25.1.1 Calling Sequence

The X.21 Protocol Control menu defaults into the Calling sequence interface control menu. This menu controls the delay times and message characters used in the standard X.21 Calling sequence (see Figure 25-5). The Maintain field is discussed in Section 25.2.

The middle part of the display contains a graphic representation of the Calling sequence timing pattern. This display is for your general assistance; it does not change when you alter the timing characteristics.

NOTE: The lead-names (T, C, R, I) on the left of this display are correct for the following two configurations: TEST DCE - TSTSWTCH and TEST DTE - TSTUSR. For the two other combinations of the Program 0 and Program C MODE fields, T and R should be transposed on the graphic display, and so should C and I. For example, if you are testing DCE and testing the User Site (in other words, emulating a DTE at the network site), you will send Proceed to Select plus (+) characters on the T lead, not on the R. This transposition applies to Called, Clearing, and Cleared timing-pattern displays also.

In the User Site Calling sequence, the user site controls M1, while the network (switching site) controls M2. These are coded character strings. M1 is the user's Selection Signal, the address ("phone number") it is trying to reach. See Figure 25-4.

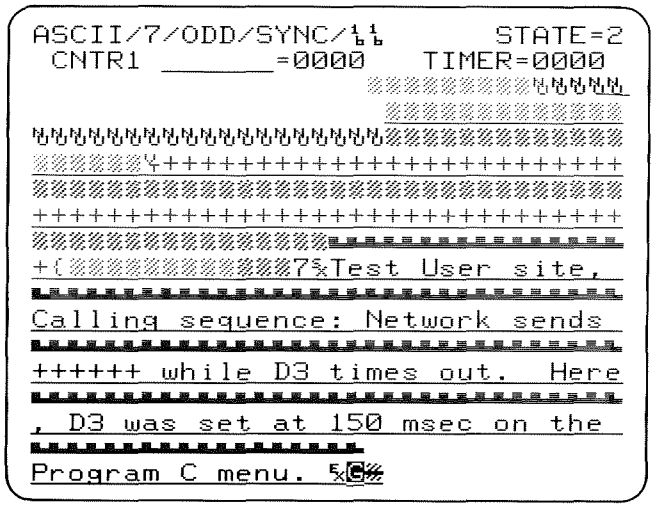


Figure 25-6 D3 is the duration of the Proceed to Select signal.

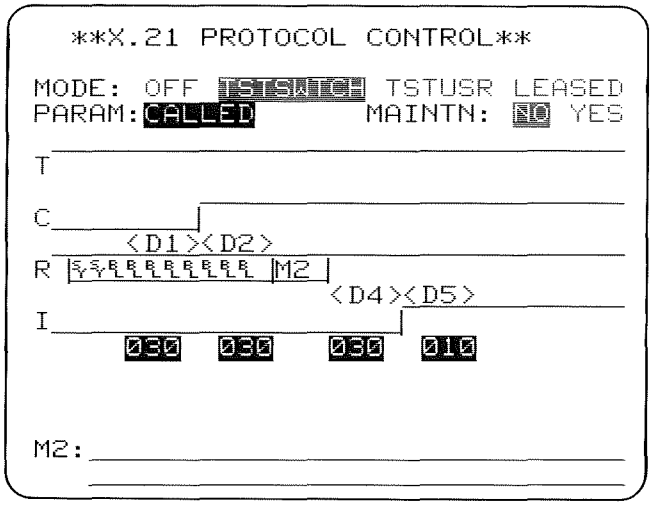
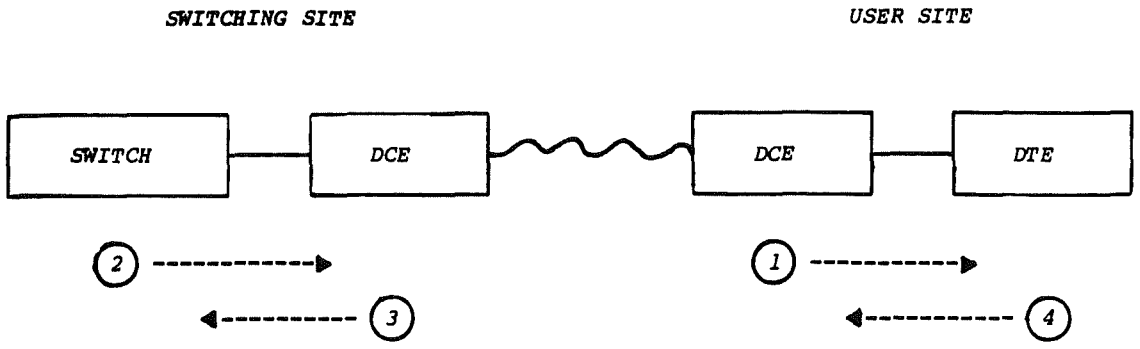


Figure 25-7 X.21 Called sequence display.



(1) TEST DTE, TSTUSR, xmit DCE-type protocol (++'s, BELLs, etc.) on R, control I.

(2) TEST DCE, TSTUSR, xmit DCE-type protocol (++'s, BELLs, etc.) on T, control C.

(3) TEST DTE, TSTSWTCH, xmit DTE-type protocol (NULLs, M1, etc.) on R, control I.

(4) TEST DCE, TSTSWTCH, xmit DTE-type protocol (NULLs, M1, etc.) on T, control C.

Figure 25-8 Test Modes selected on COMSTATE I for each of its X.21 leased-line testing roles.

If you are in TSTSWTCH mode, you can send an M1 string by making an entry on line 16 of the Program C menu, along with an X.21 CALLING entry on the Program 7 menu (see Section 23.8).

If you are in TSTUSR mode, you can send an M2 string by making an entry on line 18 of the Program C menu, along with an X.21 CALLING entry on the Program 7 screen.

When it is in TSTSWTCH mode, the COMSTATE I also controls the Selective Direct Call (SDC) field on the Program C menu. If your destination address is an SDC number, dial that number (1 through 9) in the SDC field. See Section 23.13 for the enabling entry on the Interactive Test menu.

Selections on the Program C menu also determine how long the COMSTATE I remains in each state in the various X.21 sequences. When you display the CALLING sequence on the Program C menu, you may access five separate delay times, four of them controlled by the switching site (that is, by the unit when it is in TSTUSR mode). The delay fields, with various default values, are below the timing display. As you move the cursor into one of these fields, the transition being controlled is displayed on line 14.

For example, Delay 1 (D1) represents the delay between the time the user site sends a Call Request and the time the switching site responds with a Proceed to Select. See Figure 25-3. The switching site (the COMSTATE I in TSTUSR mode) controls this delay.

D2, controlled by the user site, is the time between receipt of Proceed to Select and transmission of Selection Signals.

The rest of the Calling delays are controlled by the switching site (the COMSTATE I in TSTUSR mode). D3 represents the time that the network remains in Proceed to Select state, sending a string of plus characters (+) even after the user has responded with selection signals. See Figure 25-6. Default is 30 milliseconds, but you can substitute any delay time up to 65 seconds (65s on the menu screen).

D4 is the duration of the Connection in Progress state. This state ends when the switching site turns the I lead ON.

D5 is the duration of the Ready for Data state. The state ends when the COMSTATE I goes into Data Transfer mode, reconfiguring itself according to its Protocol Setup (Program 0) parameters.

25.1.2 Called Sequence

To select the CALLED sequence interface-control menu, move the cursor to the PARAMeter field and press ROLL. See Figure 25-7. This menu controls the delay times and message characters used in the standard X.21 Called sequence.

Here the user site (the COMSTATE I in TSTSWTCH mode) controls D1. D1 is the delay between receipt of the Incoming Call signal and transmission of Call Accepted.

The switching site (the unit in TSTUSR mode) controls M2, D2, D4, and D5.

M2 is DCE Provided Information. If you are in TSTUSR mode (whether you are DTE or DCE) and you have selected X.21 CALLED on the Interactive Test screen (see Section 23.9), you may enter any M2 information at the bottom of the Program C menu.

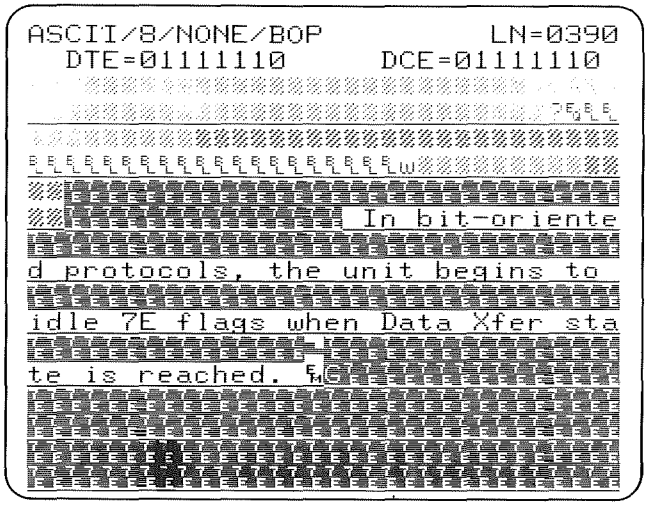


Figure 25-9 When Data Xfer state is reached, Program 0 FORMAT parameters are enabled.

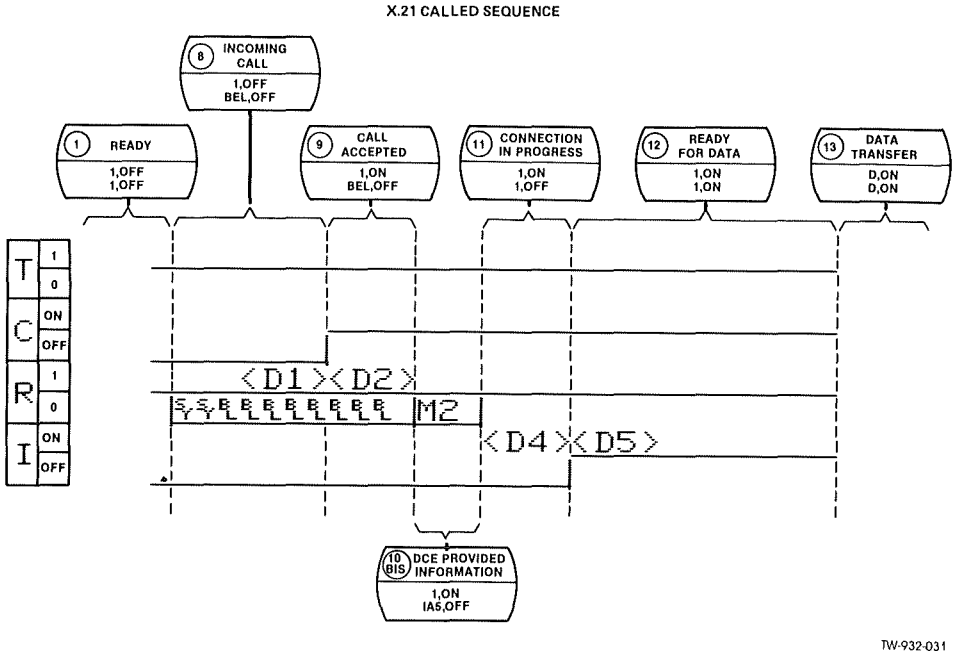


Figure 25-10 X.21 Called sequence display broken into states.

D2 is the delay between receipt of the Call Accepted signal and transmission of DCE Provided Information.

D4 is the duration of the Connection in Progress state. This state ends when the COMSTATE I raises its control lead to indicate Ready for Data.

D5 is the lenth of time that the unit sends R=1, I=ON (or full-intensity pad character in the COMSTATE I display) before the Data Transfer state is reached. At that point, the FORMAT parameters on the PROGRAM 0 menu (SYN, BOP, and so on) are enabled. Note Figure 25-9.

25.1.3 Clearing Sequence

In the X.21 Clearing sequence, the user site clears a call and expects confirmation from the network site.

The user site (the COMSTATE I in TSTSWTCH mode) controls D8. This is the delay between receipt of DCE (switching site) Ready and the transition to DTE (user site) Ready.

The switching site (the COMSTATE I in TSTUSR mode) controls D6 and D7.

D6 is the time between receipt of the Clear Request and transmission of the Clear Confirmation signal.

D7 is the switching site's delay after it has sent Clear Confirmation, before it sends DCE Ready.

25.1.4 Cleared Sequence

Here the switching site sends a Clear Indication and the user site confirms.

The user site (the COMSTATE I in TSTSWTCH mode) controls D6 and D8. The switching site (TSTUSR mode) controls D7.

D6 is the delay time before the switching site's Clear Indication is confirmed by the user. See Figure 25-15.

D7 and D8 are delay times before Ready state is resumed after a clear.

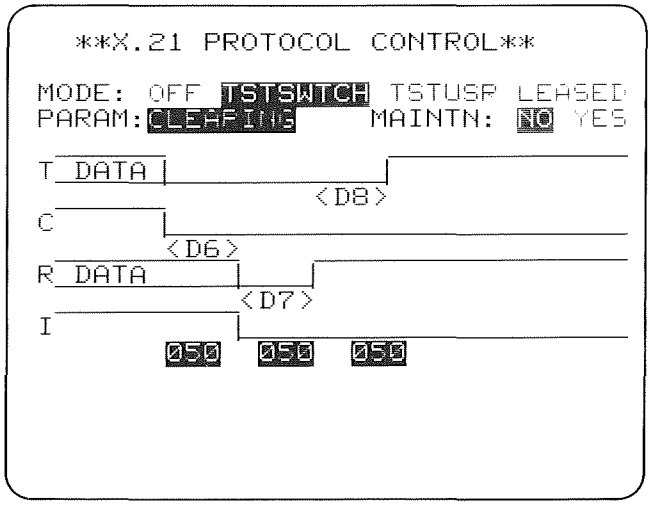


Figure 25-11 X.21 Clearing sequence display.

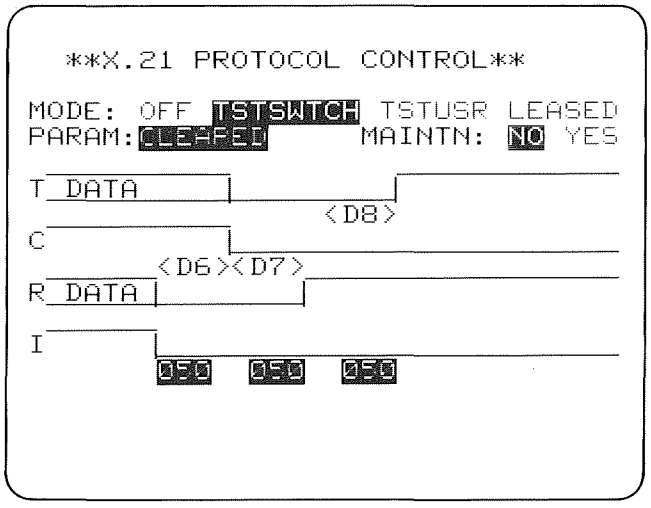


Figure 25-12 X.21 Cleared sequence display.

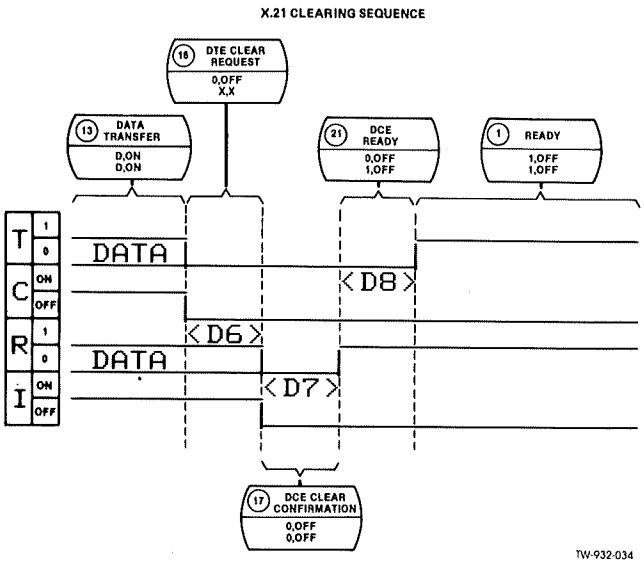


Figure 25-13 X.21 Clearing sequence broken into states.

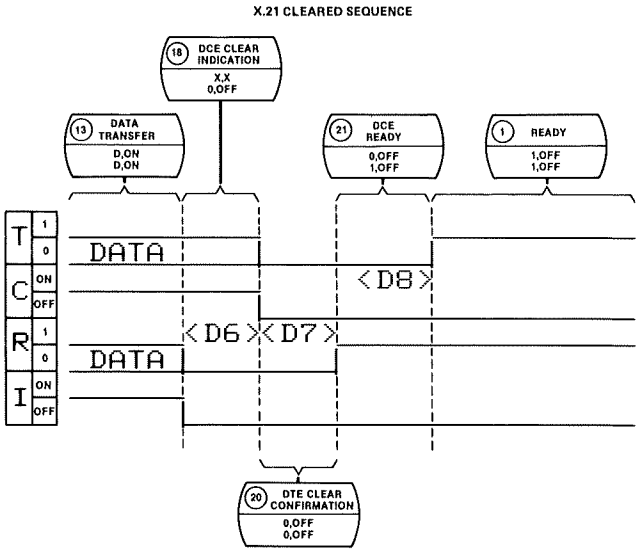


Figure 25-14 X.21 Cleared sequence display broken into states.

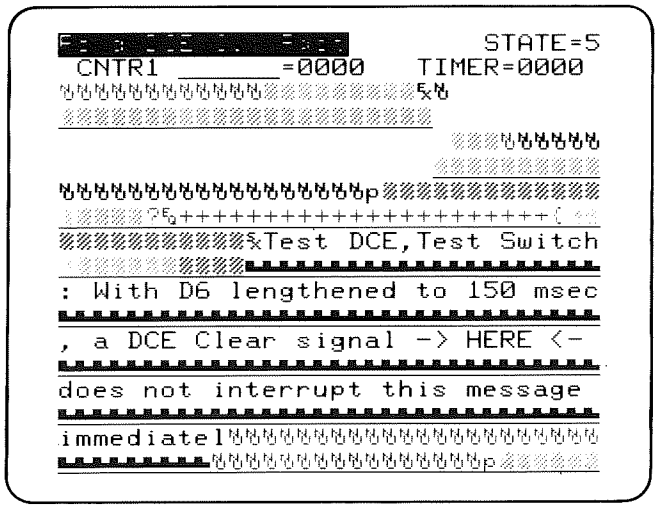


Figure 25-15 D6 is the delay time before a Clear Indication is confirmed.

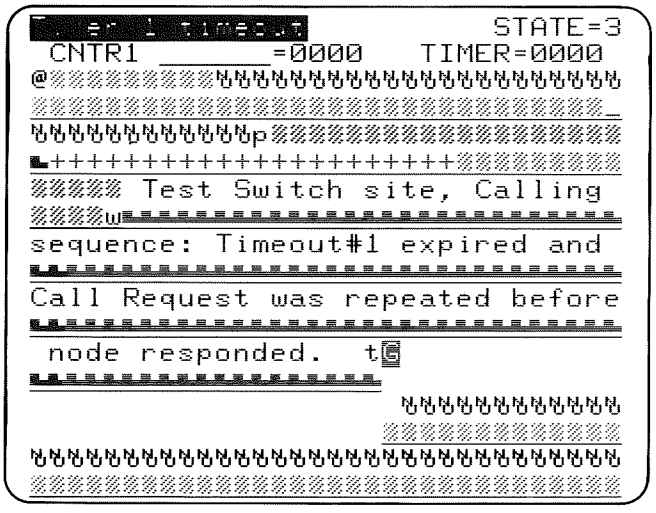


Figure 25-16 X.21 Timeout display.

25.1.5 Timeouts

The COMSTATE I can control the values for the thirteen basic timeouts used in X.21 circuit-switched service. Place the cursor in the PARAMeter field and press ROLL until TIMEOUTS is selected.

In TSTSWTCH mode, the unit checks the network site's response times against timeouts T1 through T7. In TSTUSR mode, the user's responses are checked against timeouts T11 through T16. Time limits are controlled on the Program C menu. Default values follow CCITT Recommendation X.21.

Unless otherwise specified, the time values are given in millseconds. You may designate seconds by using an "S" or a decimal point ("6S" or "6.0," for example). The largest valid entry is 65 seconds. Any entry larger than 65S will timeout after 65 seconds.

When you move the cursor to a timeout field, the timeout is defined on line 14 of the Program C screen; that is, the events that start and stop the timer are listed.

Whenever a timer controlled by the COMSTATE I expires, the unit calls up a prompt and performs an action that is part of the prescribed recovery procedure. See Figure 25-17. You can find these actions described in CCITT Recommendation X.21, Annex C, and in X.21 Testing With the INTERVIEW COMSTATE I (ATLC-107-932-103), Appendix B.

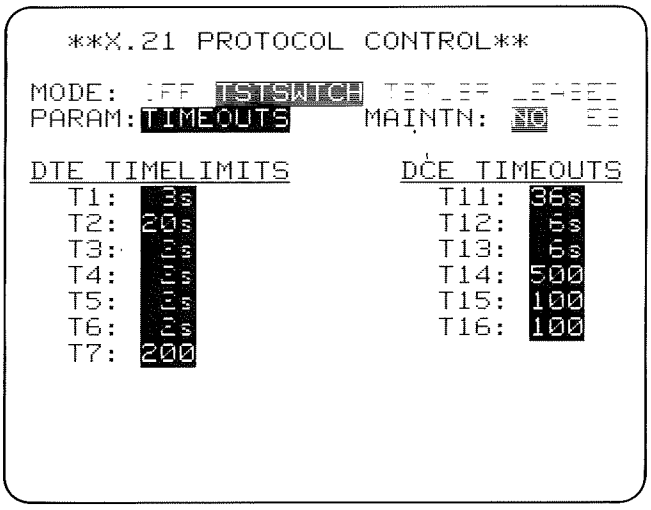


Figure 25-17 When timeout occurs, prompt is called up and action is taken.

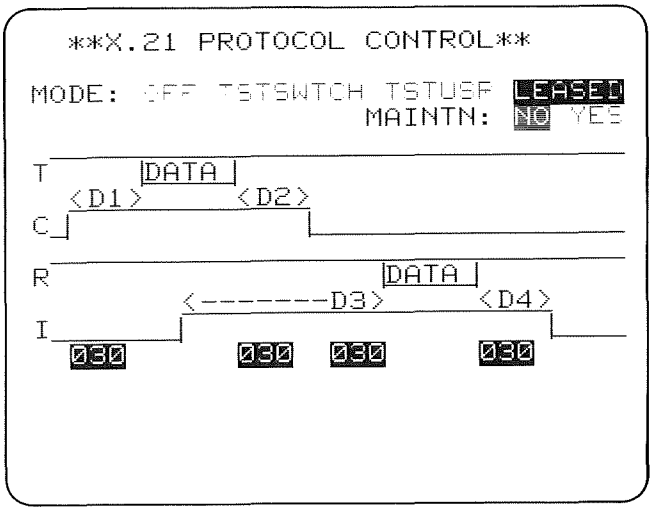


Figure 25-18 X.21 Leased mode display.

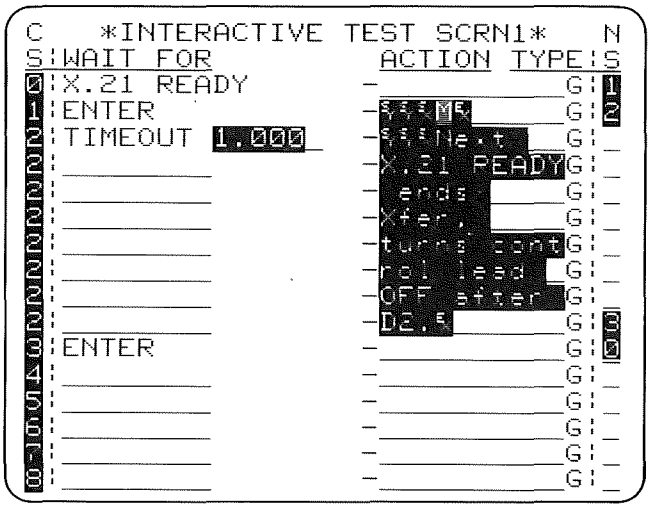


Figure 25-19 X.21 Leased, Test DCE.

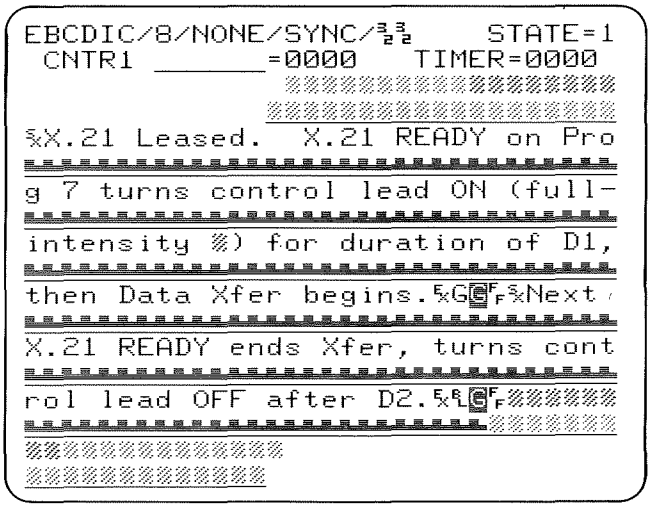


Figure 25-20

25.2 MAINTAIN

MAINTAIN lets you preserve data communications parameters even though the COMSTATE I has exited Run mode. Selecting MAINTAIN has two specific effects:

1) The active static leads of the X.21 interface controlled by the COMSTATE I maintain their voltage levels, even though the COMSTATE I is in Program mode.

2) The status of the eight internal trigger flag bits is stored.

This selection allows you to remain, for example, in Data Transfer state while you leave Run mode, enter a transmit message on the Interactive Test menu, and return to Run.

25.3 LEASED CIRCUIT OPERATION

Leased mode is used for testing X.21 Leased Circuit services. Since leased circuit conditions are much less complex than Switched circuits, the Leased circuit Protocol Control menu is much simpler. There is only one screen with four delay time fields (Figure 25-18).

There is no call sequence or handshake. The control lead simply changes state before and after data-transfer, with 30-millisecond delays that you can modify in the delay fields on the Program C menu.

In Leased mode, the only legal X.21 selection on the Interactive Test (Program 7) menu is X.21 READY. The first transmit action (State 1 in Figure 25-19) raises the control lead and initiates D1 or D3. At the end of this delay, Data Transfer begins.

Data Transfer does not end with the end of a transmission. To leave the Data Transfer state, return to a Program 7 state where X.21 READY is the WAIT FOR selection.

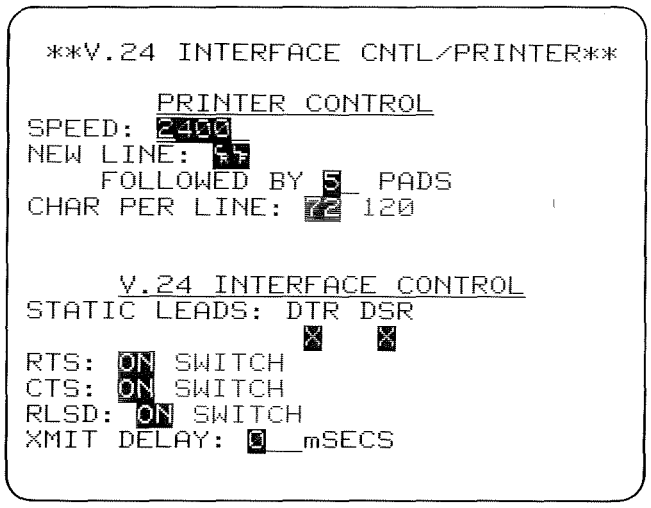


Figure 26-1 V.24 Interface Control menu (PROGRAM 5)

TABLE 26-1
COMSTATE I RS-232/V.24/V.35 HANDSHAKING CONTROL

Lead		TEST DTE Mode		TEST DCE Mode	
Pin	Name	Controls	Looks for	Controls	Looks for
Static Leads					
20	DTR	N	Y	Y	N
6	DSR	Y	N	N	Y
Switched Leads					
4	RTS	N	Y	Y	N
5	CTS	Y	N	N	Y
8	RLSD	Y	N	N	Y

26
RS-232/V.24 AND V.35 OPERATION: SETUP AND INTERFACE CONTROL

The RS-232/V.24 Interface Control menu (Figure 26-1) has two purposes: (1) to specify how the COMSTATE I is to control the RS-232/V.24 (and also V.35) leads and (2) to tell it what signals to expect from the other side of the interface. To use this menu effectively you must understand the handshaking procedure of the system you will be testing.

Table 26-1 and Figure 26-2 summarize the handshaking possibilities in the COMSTATE I's two Test modes.

26.1 STATIC LEADS: DTR, DSR

NOTE: The terms ON and OFF imply that an RS-232/V.24 or V.35 lead is driven to either on or off voltage in accordance with the RS-232/V.24 standard. The standard defines a signal as OFF when it is more negative than -3 volts with respect to signal ground. A signal is defined as ON when it is more positive than +3 volts with respect to signal ground. Thus, OFF always implies that the lead is driven to the off state and we use the term "inactive" to mean that a lead is not being driven on or off.

Use the Static Leads field to instruct the COMSTATE I to drive either DTR or DSR -- depending on the test mode -- constantly on or off. Enter a 1 for ON; and a 0 for OFF. No entry is necessary in the box for the other (received) lead.

When the COMSTATE I is in either test mode, it will drive the lead it controls on if the entry is X. If you want a static lead to be inactive, it can be manually switched out using the corresponding breakout switch (see Section 3).

The COMSTATE I will control one of the static leads at all times whenever TEST DTE or TEST DCE mode is selected. The unit does not relinquish control when it is in Program mode.

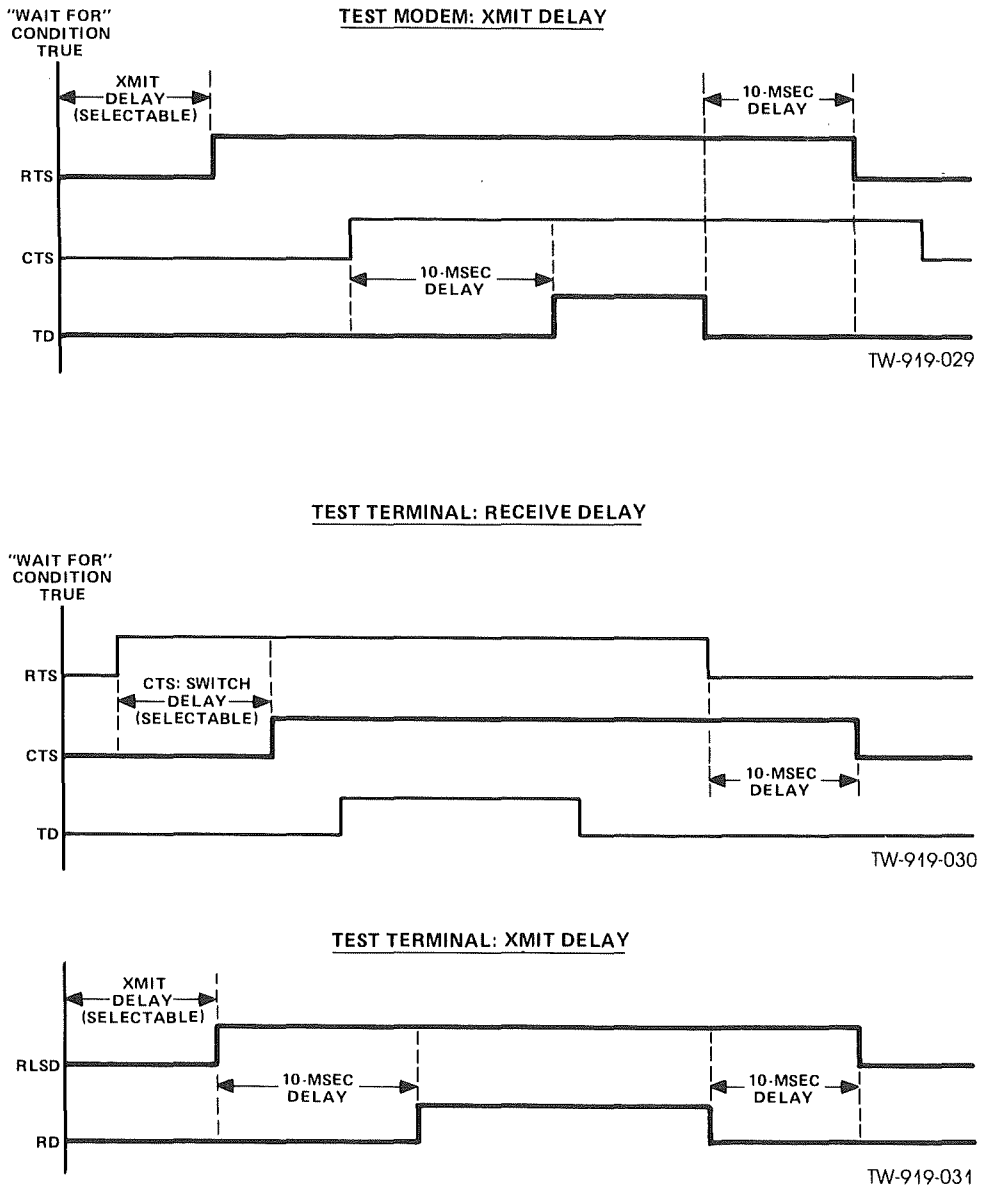


Figure 26-2 Delay times for RS-232/V.24 or V.35 leads controlled by the COMSTATE I in its Test modes. Heavy lines denote leads controlled by the COMSTATE I; lighter lines indicate the opposite side of the interface. XMIT DELAY is selected in the XMIT DELAY field of the Interface Control menu (Program 5); CTS:SWITCH DELAY, on the CTS line of that menu.

26.2 SWITCHED LEADS: RTS, CTS, RLSD

The RTS, CTS, and RLSD selections enable the COMSTATE I to turn these three leads on and off, if it is controlling them. The Mode selection determines which leads are controlled: RTS when it is in TEST DCE mode and CTS and RLSD when it is in TEST DTE mode.

Full-Duplex Systems. If the system is full duplex and the COMSTATE I is in TEST DCE mode, turn RTS ON. The COMSTATE will transmit as soon as the test conditions are satisfied (provided that CTS ON is supplied by the external source).

In TEST DTE mode, turn RLSD ON. The unit will transmit as soon as test conditions are satisfied.

Use the XMIT DELAY field to enter a delay from the time that the test conditions are satisfied to the transmission of the first character in a message. This field enables you to use characters near the beginning of a received block as the condition for transmission but delay the start of transmission until after the entire block has been received. It may also be used to simulate a response delay. When you are in DEST DTE mode, values less than 78 msec are invalid in the XMIT DELAY field. Use either 0 or a number larger than 78 msec.

Half-Duplex or Multidrop Systems. See the handshaking diagram in Figure 26-2 for the COMSTATE I handshaking sequences and delay times.

In half-duplex operation, select SWITCHED for RTS, CTS, and RLSD.

When you have selected SWITCH for RTS, you may enter a delay in the XMIT DELAY field (see above). Without a delay entry, the unit (in TEST DCE mode) will send data 10 msec after it sees CTS come on and it will turn RTS off 10 msec after it has completed the message. If you depress the PROGRAM key to leave the Run mode, the RTS lead will go off.

When you have selected SWITCH for CTS (see Figure 26-3), you may enter a delay time of from 0 to 999 msec in the DELAY field on the same line. DELAY is a decimal field with a default value of 250 msec. When the COMSTATE I (in TEST DTE mode) sees RTS go on it will wait this delay before turning CTS on. After it sees RTS go off, it will wait 10 msec to turn CTS off. If you depress the PROGRAM key to leave the Run mode, the CTS lead will remain in its current state.

When you have selected RLSD SWITCH, the COMSTATE (in TEST DTE mode) will turn RLSD on as soon as the conditions for transmission are satisfied unless you have entered a delay time in the XMIT DELAY field. It will send data 10 msec after it turns RLSD on, and turn RLSD off 10 msec after the block check characters or the end of transmission. If you press the PROGRAM key to leave Run mode, the RLSD lead will be turned off.

In multidrop systems, the selections depend on which side of the communication link you are on. If you are testing the host DTE, select CTS: ON and RLSD: SWITCHED. (You do not control RTS.) If you are testing a drop DTE, select CTS: SWITCHED and RLSD: ON.

If you are emulating the host, testing DCE, select RTS: ON. (CTS and RLSD are not under your control.) If you are testing DCE from the drop side of the line, select RTS: SWITCHED.

26.3 MANUAL INTERFACE CONTROL

All ten RS-232/V.24 and V.35 interface leads can be controlled ON and OFF manually through the breakout switches on the interface panel of the COMSTATE I. The breakout switches are explained in Section 3.

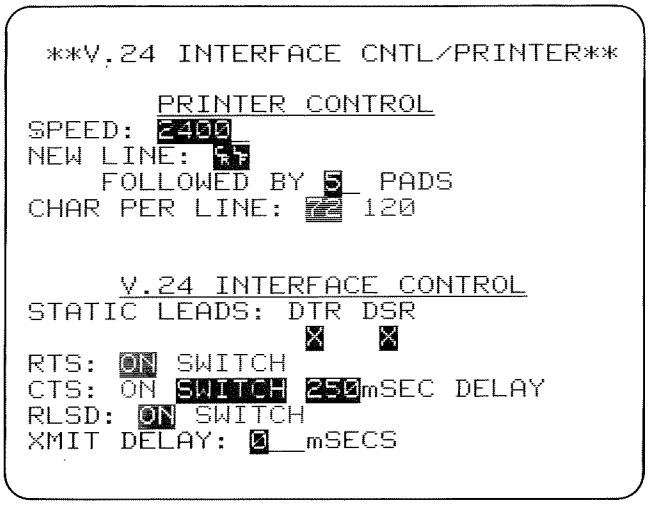


Figure 26-3 Setting a delay before CTS goes on.

27 BIT ERROR RATE TESTING

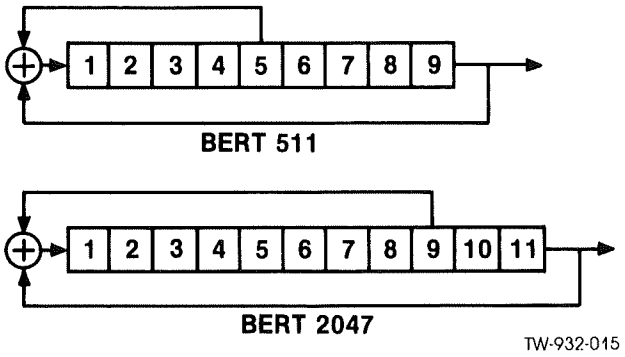


Figure 27-1 BERT algorithms.

TABLE 27-1
BERT 511 AND 2047 SPECIFICATIONS

Parameter	Synchronous	Asynchronous (or ISOC)
BERT algorithm	See Section 27.1	See Section 27.1
Framing	No synchronization characters	Start bit and 1, 1.5, or 2 stop bits
Block length	1000 bits	1000 bits
Embedded parity	None	None, even, or odd
Information bits	8, 7, 6, or 5	8, 7, 6, or 5 (NOTE: For BERT 2047, 5 information bits should not be selected.)

27
BIT ERROR RATE TESTING

27.1 PSEUDORANDOM BIT PATTERN

The COMSTATE I can transmit and analyze Bit Error Rate Tests using either a 511- or a 2047-bit pseudorandom pattern. The algorithm for each pattern is shown diagrammatically in Figure 27-1.

The BERT 511 pattern is generated by a 9-bit shift register. The new bit 1 is always the exclusive OR of Bits 5 and 9; that is, Bits 5 and 9 are the feedback points.

The BERT 2047 pattern is generated by an 11-bit shift register with Bits 9 and 11 as feedback points.

27.2 COMPATIBILITY WITH BERT EQUIPMENT

When another BERT generator-analyzer is used in conjunction with the COMSTATE I, the first step in setting up a BERT test is to ensure that it is compatible with the COMSTATE I's BERT logic.

As shown in Table 27-1, the COMSTATE I can send and analyze either pattern in Synchronous or Asynchronous (or ISOC) Mode. No block check calculations will be sent, but in asynchronous operation, parity can be embedded. The COMSTATE I can analyze either its own looped-back pattern, or a pattern received from another BERT generator -- which may be another COMSTATE I.

The other BERT generator-analyzer must fit the specifications defined in Table 27-1, and the Protocol Setup (Program 0) menu of the COMSTATE I must match the setup of the other equipment.

27.3 INTERFACE CONTROL AND HANDSHAKING

To specify interface control or handshaking for BERT transmission or analysis, use the Interface Control menu (Program 5 for RS-232/V.24/V.35, Program C for X.21).

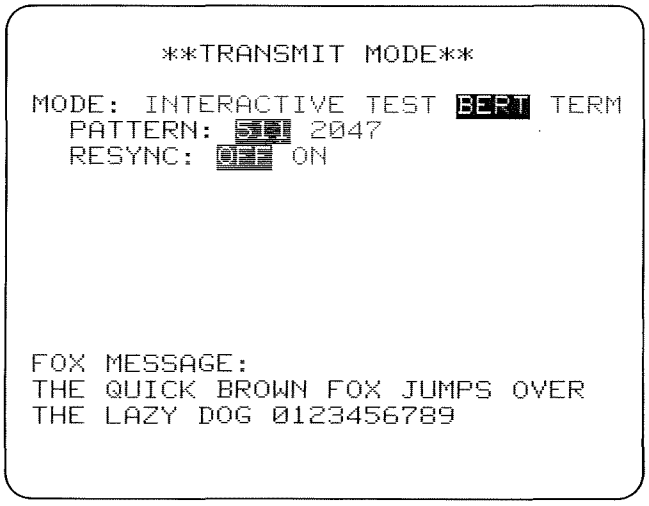


Figure 27-2 Selecting Bit Error Rate Testing.

27.4 SELECTING BERT MODE

CAUTION: As soon as the COMSTATE I is switched to either of its Test modes, it will interfere with any active communications on the interface. Be sure that it is all right to break the line and transmit test data on it.

On the Protocol Setup menu, select either TEST DCE or TEST DTE. Then select BERT Mode on the Transmit Mode menu (PROGRAM 6; see Figure 27-2). Selecting BERT brings up two more fields, PATTERN, and RESYNC. When you have made your selections in these fields (see Section 27.6), press the RUN key. The COMSTATE I will automatically begin BERT operation.

27.5 TRANSMISSION FORMAT: PROTOCOL SETUP MENU (PROGRAM 0)

27.5.1 Format

Choose SYNC, ASYNC, or ISOC format. Select the number of information bits. For ASYNC or ISOC format, you may choose EVEN or ODD parity. MRK and SPACE are not valid selections; if you select MRK or SPACE, the COMSTATE I will use EVEN parity.

NOTE: For BERT 2047 mode, 5 information bits should not be selected.

27.5.2 Clock

If clock is to be supplied by a modem during the test, you can select CLOCK:EXT. If no external clock is to be supplied, select INT and the correct speed.

27.6 TRANSMIT MODE MENU (PROGRAM 6)

27.6.1 Pattern

Choose between a 511-bit and a 2047-bit pseudorandom pattern. The COMSTATE I both transmits and expects to receive this pattern while it is in BERT mode.

27.6.2 Resync ON

Resync ON allows you to take a long-term error reading and get back into synchronization after a short interruption. After a FAULT has been detected (see NUMBER OF FAULTS in Section 27.9),the receiver resynchronizes every time a bit slips. Resync On avoids a 100 per cent error rate over a long error count.

27.6.3 Resync OFF

If you wish to take a reading on a noisy circuit that has a high error rate, you can measure the error rate without carrier drop out and resynchronization. Instead of going out of and back into synchronization, the receiver will continue to count errors.

27.7 RUN MODE: KEYBOARD CONTROL

Whenever you press the RUN key, the COMSTATE I will begin to operate as both a BERT generator and analyzer.

It will immediately begin transmitting the bit pattern chosen on the Transmit Mode menu according to the format entered on the Protocol Setup menu. The pattern will repeat until you press the PROGRAM key. If you then press the RUN key, transmission of the pattern will begin again. If you press the RUN key while the pattern is being transmitted, the pattern will not be interrupted.

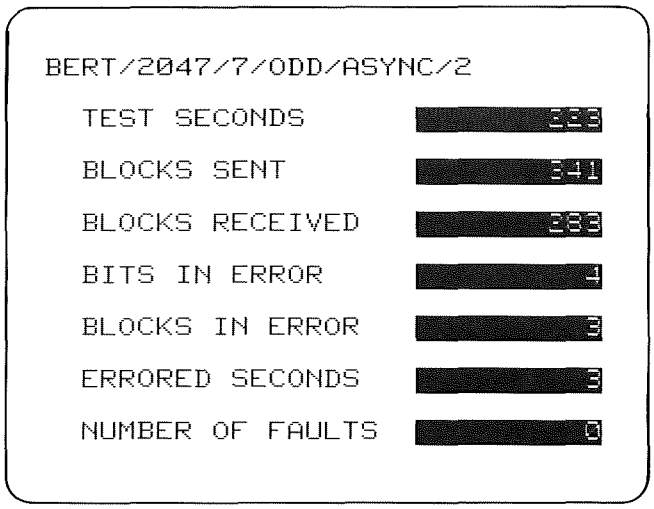


Figure 27-3 Status line indicates type of BERT test.

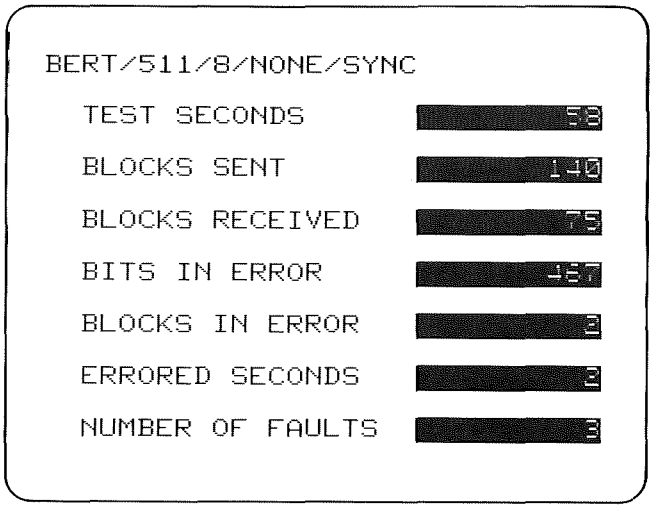


Figure 27-4

The COMSTATE I also immediately begins performing a BERT statistical analysis on all received data. To reset the BERT statistics counters without stopping transmission of the pattern, press either the RUN or the CLEAR key.

To get out of BERT mode, display the Transmit Mode menu (PROGRAM 6) and select INTERACTIVE TEST or TERMinal mode.

You may introduce errors into the BERT transmission with the DON'T CARE key. One errored bit will be sent each time the DON'T CARE key is depressed.

You may prevent the BERT pattern from being transmitted while the COMSTATE I analyzes a received pattern. For RS-232/V.24 operation, if the COMSTATE I is in TEST DCE mode, move the breakout switch for pin 2 (TD) to the OPEN position; if it is in TEST DTE mode, move the switch for pin 3 (RD) to OPEN.

For X.21 operation, move the breakout switch for pins 2 and 9 (T) to the OPEN position if the COMSTATE I is in TEST DCE mode; if it is in TEST DTE mode, move the switch for pins 4 and 11 (R) to OPEN.

For V.35 operation, move the breakout switch for pins P and S (TD) to the OPEN position if the COMSTATE I is in TEST DCE mode. If it is in TEST DTE mode, move the switch for pins R and T (RD) to OPEN.

The FREEZE key is useful for reading and recording the counter values. It stops the counters, but does not stop transmission of the BERT pattern. (Note: The Freeze indicator does not light in BERT mode.)

27.8 RUN MODE: STATUS LINE

The status line of the Run Mode BERT display, shown in Figure 27-3, identifies the BERT Test (511 or 2047) and the parameters chosen on the Protocol Setup menu. The COMSTATE I is using these parameters both to transmit a BERT pattern, and to analyze any received pattern. Figure 27-3 shows a BERT 2047 test with odd parity on 7 information bits, in asynchronous mode with 2 stop bits. Figure 27-4 shows a BERT 511 test with 8 information bits, no parity, in synchronous mode.

27.9 RUN MODE: STATISTICAL DISPLAY

TEST SECONDS. This counter is incremented once for every second the test runs.

BLOCKS SENT. The current number of 1000-bit blocks sent is recorded here.

BLOCKS RECEIVED. This shows the current number of 1000-bit blocks received. If this count is not incrementing, the COMSTATE I is not receiving and analyzing a pattern.

BITS IN ERROR. The bit sequence received is compared with that expected in accordance with the algorithm diagrammed in Section 27.1 and the parameters chosen on the Protocol Setup menu. The count of received bits that do not match the expected pattern is displayed here.

BLOCKS IN ERROR. The number of blocks in which one or more bit errors have occurred is recorded.

ERRORED SECONDS. This counter will increment when the TEST SECONDS counter increments if one or more errors have been found during the last second.

NUMBER OF FAULTS. A "fault" is recorded whenever an error is detected in more than 24 percent of the bits received over a certain period of time (approximately 16 contiguous characters in 64 received characters). This percentage is considered sufficient to indicate that a data transition has been missed.

If RESYNC:ON has been selected on the Transmit Mode menu the COMSTATE I's receiver will resynchronize every time a "fault" is found.

27.10 LOOPBACK AT THE TRANSMITTING COMSTATE I

The COMSTATE I can analyze its own BERT transmission without being connected to the data interface. This is a good way for you to become familiar with the BERT test procedure before you apply it to a system.

With the interface disconnected, power up the COMSTATE I and select BERT mode in accordance with the instructions in Section 27.4. On the Protocol Setup menu, select TEST DTE, then select a configuration compatible with the specifications in Table 27-1. Select INTernal CLOCK.

Press the RUN key. You will see only the first two counters, Test Seconds and Blocks Sent, incrementing. This is the way the Run Mode display will appear when you are sending the BERT pattern to another BERT analyzer. No statistical analysis is being done because the BERT analyzer is not seeing the transmitted pattern.

Press the PROGRAM key. On the interface panel, patch TD to RD (T or R). Press the RUN key. This time, you will see the first three counters incrementing: Test Seconds, Blocks Sent, and Blocks Received. The COMSTATE I's BERT analyzer can now see its own transmission but it is unlikely that it will find any errors in its own data.

Use the DON'T CARE key to introduce errors into the transmission and observe the next three counters. The DON'T CARE key will not introduce a fault.

28
OPERATING IN TERMINAL MODE

The COMSTATE I can operate as an asynchronous remote terminal, either to test a network or to communicate with another point in the network. When in terminal mode, all triggers and display enhancements remain active, but selections on the Interactive Test menu are disabled. Operation as a terminal requires a front-panel interface and special selections on the Protocol Setup menu and the Transmit Mode menu.

NOTE: There is a second Terminal mode in the COMSTATE I, for use when the unit is acting as a "dumb" terminal to control another COMSTATE I or INTERVIEW 30/40 remotely. This other Terminal mode uses the PRINTER/REMOTE interface and the Program A menu, and is described in Section 31.5.

28.1 PROTOCOL SETUP MENU SELECTIONS

To use the COMSTATE I as an asynchronous terminal, make the protocol selections appropriate for your network on the Protocol Setup menu. The only restriction is that the Format must be asynchronous (ASYN) or isochronous (ISOC). All other selections on the menu are valid and active, including the display Suppress and Enhance fields.

When using the COMSTATE I as a remote terminal in a network, you want the unit to emulate a terminal. Therefore, select TEST DCE on the Protocol Setup menu. If you select TEST DTE, the COMSTATE I will emulate a host in communicating directly with another terminal. Selecting MONitor displays all traffic on the data line in regular text, rather than in the COMSTATE I's data communications format.

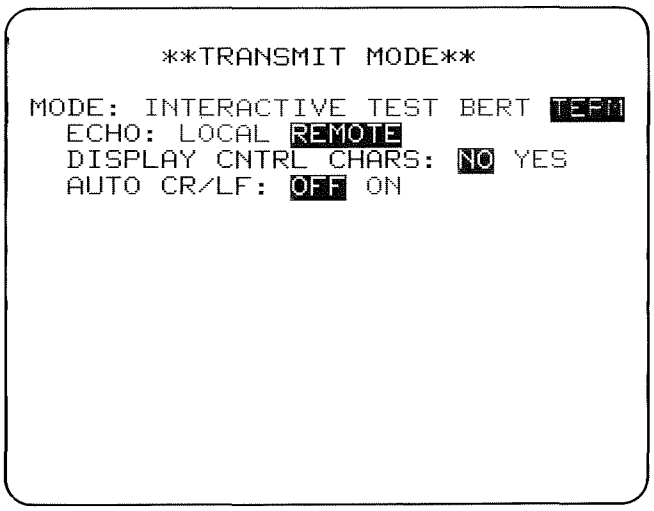


Figure 28-1 Selecting TERMINAL mode.

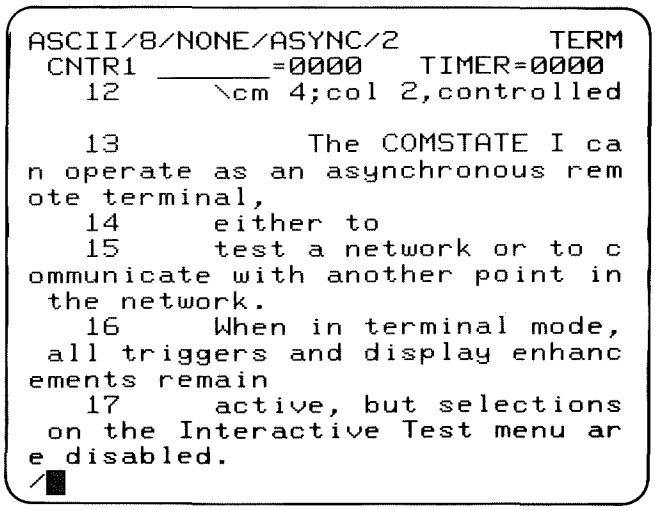


Figure 28-2 Operating as an asynchronous terminal.

28.2 TRANSMIT MODE MENU SELECTIONS

Once the Protocol Setup menu is complete, press PROGRAM 6 to display the Transmit Mode menu. Here select TERM as the operating mode. This displays three new fields, as shown in Figure 28-1.

(a) Echo. In this field select REMOTE if the host will be confirming the COMSTATE I's transmissions by returning an echo. Select LOCAL to have the keyboard's input displayed directly on the CRT.

(b) Display Control Characters. Selecting NO in this field will suppress control characters such as carriage returns from the CRT display. Selecting YES will display these characters.

(c) Auto CR/LF. Selecting ON in this field will automatically cause a line feed on the COMSTATE I's CRT display for every carriage return. This will not, however, actually generate a line feed control character (LF); it is for display purposes only. If OFF is selected, a carriage return simply returns the cursor to the left margin on the same line.

NOTE: If you are displaying control characters, AUTO CR/LF should be ON. Otherwise, your carriage return will move the cursor to the first character on the current line. When the host returns a line feed, that control character will overwrite a text character on the current line before the COMSTATE performs the line feed.

28.3 TERMINAL MODE OPERATION

Press the RUN key to initiate Terminal mode operation. When in Terminal mode, the COMSTATE I acts as a normal "dumb" terminal. See Figure 28-2.

The display screen is 32 columns wide. When a line longer than 32 columns is received by the COMSTATE I, the display automatically wraps onto the next line.

All of the grey alphanumeric keys are valid, as are some of the blue-grey keys:

- The CLEAR key clears the display and the data buffer.
- The FREEZE key gives you access to the 32-kilobyte data buffer where you may use the cursor keys to review the recent terminal activity.
- The HEX key shifts the display into hexadecimal, and actual hexadecimal values for any additional key entries will be displayed.
- SHIFT-HEX or CONTROL-HEX displays only control characters in hexadecimal.
- PROGRAM returns you to the Menu Selections menu.

All control characters are also valid. The terminal not only displays the control characters, it acts on them as well. Thus, CONTROL-H prints BS (hex) and moves the cursor back one space. If you select DISPLAY CNTRL CHARS: NO, you will not see the control characters on the screen, only their actions.

Two keys have special control functions in Terminal mode: + and \. Pressing CONTROL and + simultaneously produces an escape character (ESC). CONTROL and \ functions as a Break (the COMSTATE I holds a mark for 250 milliseconds). These functions are only valid in Terminal mode.

PART VI
UTILITIES

29
EXPANSION MEMORY: STORING PROGRAMS AND DATA

Any of four types of memory cards may be installed in the COMSTATE I's expansion memory:

(1) Volatile Random-Access Memory (VRAM; Option 22-1). VRAM cards are erased whenever the COMSTATE I is turned off. The advantage of VRAM is that data can be written into it very quickly. It is especially useful for developing a program library; the finished version can be transferred to a nonvolatile memory card before the COMSTATE I is turned off. Its speed also makes it ideal for downloading a group of tests with the Remote Program Transfer utility.

(2) Nonvolatile Random Access Memory (NRAM; Option 23-x); CMOS with battery backup. Since this is a battery back-up memory board, power is on the RAM chips all the time, even when the board is removed from the unit.

CAUTION: Care should be taken to avoid short-circuiting the track when handling or storing the board. A short circuit could cause the loss of memory and possible permanent damage.

CAUTION: The circuitry on the NRAM card is CMOS. Subjecting it to static discharge will damage the circuitry.

(3) Electrically Erasable Read-Only Memory (EROM; Option 24-1). The write operation is somewhat slower than for VRAM, but these cards are nonvolatile. They can be erased without removing them from the COMSTATE I.

(4) Ultraviolet-Erasable Read-Only Memory (UROM; Option 21-2). UROM cards have the advantage of 64 K bytes of storage (the same as one of the NRAM cards).

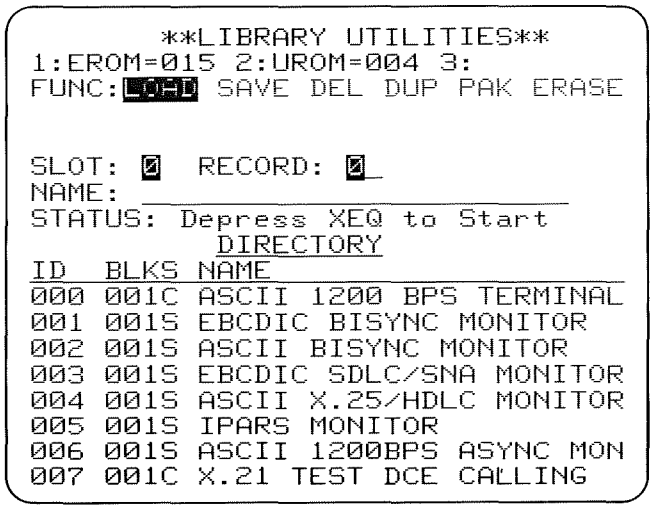


Figure 29-1 The Library Utilities menu (PROGRAM 9).

They also have the advantage of being secure, in that they cannot be erased in the COMSTATE I. The write process is slow, however, and they can be erased only in special UV equipment.

The Library Utilities (Figure 29-1) menu is used for most management of the COMSTATE I's expansion memory. (The LOAD function can also be executed from the trigger menus and from the Interactive Test menu.) From the Library Utilities menu, you can:

- NAME any program or data when it is saved;
- LOAD any program or data from the expansion memory;
- SAVE programs or data in the expansion memory;
- DELete programs or data in the expansion memory from the directory;
- DUPlicate an entire memory card.
- PAcK the contents of a memory card to make more memory blocks available for writing.
- ERASE any nonprotected RAM or electrically erasable ROM memory card.

The Library Utilities menu can also be used for loading or duplicating program Setups from the permanent, internal memory. These are the directory entries with Slot number 0.

29.1 BLOCKS AND RECORDS

One block of memory is 128 bytes (80 hex bytes). The group of memory blocks occupied by one Setup, Test, or Data Buffer excerpt is considered one record. The number of blocks in a record varies.

29.2 MEMORY STATUS LINE (Line 2)

There are four types of memory cards that may be installed in the three slots of the Memory Adapter-Programmer board. Up to three cards of one type or any combination of two or three types may be installed in any order. On Line 2, the memory status line, the type of card currently in each slot is identified as one of the following:

UROM = Ultraviolet-erasable ROM (OPT-21);
VRAM = Volatile RAM (OPT-22);
NRAM = Nonvolatile RAM (OPT-23);
EROM = Electrically erasable ROM (OPT-24).

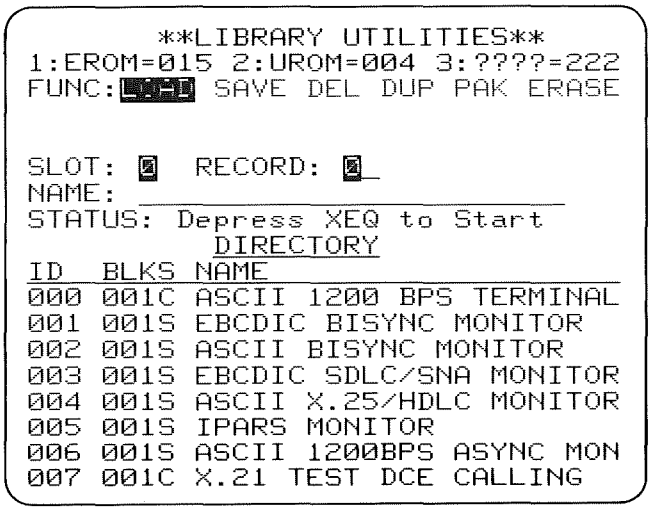


Figure 29-2 COMSTATE I displays ???? when it cannot identify type of memory card.

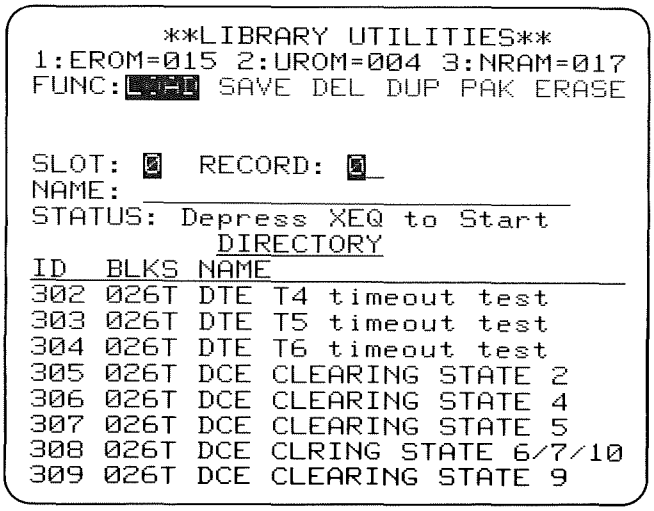


Figure 29-3 The directory may be several pages long.

If the COMSTATE I cannot identify the type of memory card in a slot, the memory type for that slot will be displayed as question marks (????; see Figure 29-2). If this happens, check that DIP switch S1 on the memory card in that slot is set correctly (see Section 29.7).

The number of memory blocks currently available for writing is also displayed for each card.

The COMSTATE I uses a linked-list structure to keep track of blocks already allocated to records and of blocks available for writing. If this linked list is in error, the COMSTATE I will be unable to determine the number of blocks available for writing. In this case, the number of memory blocks available will be displayed as question marks (????).

If this happens, exit and reenter the menu. If this does not allow the error to be corrected, see Section 29.5 for more information.

29.3 THE DIRECTORY; ADDRESSING

To see the entire directory page by page (compare Figure 29-3 with Figure 29-1), press SHIFT or CONTROL with the UP or DOWN arrow for each page. The cursor will not move from the program fields on the top half of the menu into the directory.

29.3.1 ID Number

The first digit of each ID number in the directory is the SLOT number, which tells you on which memory card the directory entry is stored.

A slot number of zero means that the entry is in the permanent internal memory, rather than on one of the three expansion memory cards. Thus, the first nine items in the directory are factory-installed protocol setups. (These include two X.21 interactive tests.) Slot numbers 1, 2, and 3 refer to the numbered slots on the Adapter-Programmer board. To tell which type of memory is on the card in a particular slot, see Line 2 of the menu (Section 29.2).

The second and third digits in the ID number are the RECORD number in the memory, whether internal memory or an expansion memory card.

29.3.2 Blocks

The three digits in the BLKS column tell you how many blocks of memory the record occupies.

The letter tells you the TYPE of the entry, as follows:

S = SETUP, the Protocol Setup and BCC Parameters menus (PROGRAMs 0 and B).
T = TEST, an entire COMSTATE I test program, that is, the PROGRAM 0, 1, 2, 3, 4, 5, 6, 7, B, C, and D menus.
C = CANNED TEST, occupying one memory block. Slot 0 only.
D = DATA, data and enhancements from the CRT Data Buffer.

29.3.3 Name

A NAME will appear in the directory if a name was saved with the program or data entry.

TABLE 29-1
EXECUTION TIMES FOR LIBRARY FUNCTIONS

Function	Nonvolatile or Volatile RAM (16k)	Nonvolatile RAM (64k)	Electrically Erasable ROM (16k)	UV-Erasable ROM (64k)
LOAD (one record)	<1 sec	<1 sec	<1 sec	<1 sec
SAVE				
Setup	<1 sec	<1 sec	<3 sec	<10 sec
Test	<1 sec	<1 sec	<30 sec	<90 sec
Data (up to 255 lines of Data Buffer)	<1 min	<1 min	<3 min	<15 min
DELete (one record)	<1 sec	<1 sec	<1 sec	<1 sec
DUPlicate				
From 16k RAM to:	<1 min	<10 sec	<3 min	<15 min
From 64k RAM to:	See Note 1	<40 sec	See Note 1	<60 min
From electrically erasable ROM to:	<10 sec	<10 sec	<3 min	<15 min
From UV-erasable ROM to:	See Note 1	<40 sec	See Note 1	<60 min
PAcK (full card)	<5 sec	<20 sec	<6 min	See Note 2
ERASE (full card)	<1 sec	<1 sec	<3 min	See Note 2

Note 1: A card cannot be duplicated to a smaller card.
Note 2: UV ROM cards cannot be erased by the INTERVIEW.

29.4 FUNCTIONS

Here you select which of six library functions is to be executed when you press the XEQ key. The time for execution depends on the Function and the Type of the memory card, as summarized in Table 29-1.

29.4.1 LOAD

This selection (Figure 29-4) allows you to load any Setup, Test, or Data (see Section 29.3.2) listed in the directory.

Enter the SLOT number to choose the memory card -- or zero for any of setups in internal memory. Then enter the RECORD number, using either one or two digits. Press the XEQ key.

The name of the material being loaded will be shown in the NAME field. The STATUS line will display LOADING, followed by LOADED.

When you load DATA from one of the memory cards, it is placed in the data buffer. To see it, press PROGRAM, F, without leaving Program mode. To enhance or run a trigger program against the data in the buffer, select REANALYZE mode on the Program 0 menu and press RUN. Section 15 describes this mode.

29.4.2 SAVE

You can SAVE (Figure 29-5) a program Setup, a complete Test, or Data from the Data Buffer to any expansion memory card, provided it is not write-protected (see Section 29.7). You cannot save to the internal memory (Slot 0).

When you select SAVE, a TYPE field is displayed on Line 4. Be sure to select the correct TYPE (see Section 29.3.2). If you select DATA, you must enter the buffer line number RANGE on Line 5: the FROM number in the first field, and the TO number in the second field.

NOTE: The COMSTATE I can save up to 1019 lines of its data buffer to a 64-K memory card.

```
        **LIBRARY UTILITIES**
1:EROM=015 2:UROM=004 3:NRAM=017
FUNC:LOAD SAVE DEL DUP PAK ERASE

SLOT: 3  RECORD: 02
NAME: [illegible]
STATUS: LOADED
          DIRECTORY
ID  BLKS NAME
302 026T DTE T4 timeout test
303 026T DTE T5 timeout test
304 026T DTE T6 timeout test
305 026T DCE CLEARING STATE 2
306 026T DCE CLEARING STATE 4
307 026T DCE CLEARING STATE 5
308 026T DCE CLRING STATE 6/7/10
309 026T DCE CLEARING STATE 9
```

Figure 29-4 Loading a test from the library.

```
        **LIBRARY UTILITIES**
1:EROM=065 2:UROM=004 3:NRAM=017
FUNC:LOAD SAVE DEL DUP PAK ERASE
TYPE: SETUP(S) TEST(T) DATA(D)
RANGE: LINE 0___  TO LINE 100_
SLOT: 1
NAME: SDLC-SNA Interactive___
STATUS: SAVING
          DIRECTORY
ID  BLKS NAME
000 001C ASCII 1200 BPS TERMINAL
001 001S EBCDIC BISYNC MONITOR
002 001S ASCII BISYNC MONITOR
003 001S EBCDIC SDLC/SNA MONITOR
004 001S ASCII X.25/HDLC MONITOR
005 001S IPARS MONITOR
006 001S ASCII 1200BPS ASYNC MON
007 001C X.21 TEST DCE CALLING
```

Figure 29-5 Saving data from the buffer to EEROM memory.

```
        **LIBRARY UTILITIES**
1:EROM=128 2:NRAM=353 3:NRAM=222
FUNC:LOAD SAVE DEL DUP PAK ERASE


SLOT: 3  RECORD: 00
NAME: Chain Error
STATUS: DELETED
            DIRECTORY
ID   BLKS NAME
008  001C X.21 TEST DCE CALLED
200  009D X.25 Test Data
201  026T SDLC-SNA Force Error
202  026T SDLC-SNA SessionDeactiv
203  010T Sense Data present
204  025T Chain Error
300  010T Enhance BCI-ECI
301  024D X21 data
```

Figure 29-6 Deleting an entry from the directory.

```
        **LIBRARY UTILITIES**
1:EROM=128 2:UROM=004 3:NRAM=511
FUNC:LOAD SAVE DEL DUP PAK ERASE


SLOT: 2  TO  SLOT: 3
NAME:
STATUS: DUPLICATING
            DIRECTORY
ID   BLKS NAME
000  001C ASCII 1200 BPS TERMINAL
001  001S EBCDIC BISYNC MONITOR
002  001S ASCII BISYNC MONITOR
003  001S EBCDIC SDLC/SNA MONITOR
004  001S ASCII X.25/HDLC MONITOR
005  001S IPARS MONITOR
006  001S ASCII 1200BPS ASYNC MON
007  001C X.21 TEST DCE CALLING
```

Figure 29-7 Duplicating the UROM onto the NRAM.

NOTE ALSO: The line number at the top of the data-buffer screen at any given time is the number of the top line on that screen, not the bottom line and not the line with the cursor. To save all data on that screen, add 16 to the line-number value that is displayed.

On Line 6, enter the Slot number of the memory card that is to be saved (0, the internal memory, is illegal).

SAVE does not write over any previously written blocks. Each time a Save is performed, the new material is written beginning at the block following the last previously recorded block, and the record number is assigned automatically. Since there is no need to specify the record number, the RECORD field goes away.

In the NAME field, name the program or data that you want to save. Up to 23 alphanumeric and control characters are allowed. Hexadecimal characters and special keys such as Bit Mask and Flag are illegal.

Press the XEQ key. The STATUS line will display SAVING; then SAVED. The ID, BLKS, and NAME for the new entry will automatically be inserted in the correct place in the directory. The Memory Status line (Line 2) will be revised to show the number of memory blocks available on the card.

29.4.3 DELETE

DELete (Figure 29-6) deletes from the directory the entry at the address selected on Line 6. Whenever an entry is deleted, the ID numbers for that card are renumbered to maintain the numerical sequence.

The location of the deleted directory entry in memory is only flagged (not erased) so that it can be recognized by the PACK function.

NOTE: If you want to delete all blocks from a card, use ERASE.

NOTE: Entries cannot be DELeted from write-protected cards.

29.4.4 DUPLICATE

Any memory card can be copied to any other blank, non-Write-Protected card of the same or larger size with the DUPlicate function (Figure 29-7). The memory content will be copied exactly: if the memory card has not been PAcKed, the duplicate will not be packed. Enter the Slot number of the card to be copied in the first field on Line 6. In the second field, enter the Slot number of the card to which you are writing.

NOTE: A card cannot be duplicated onto a card that is not blank.

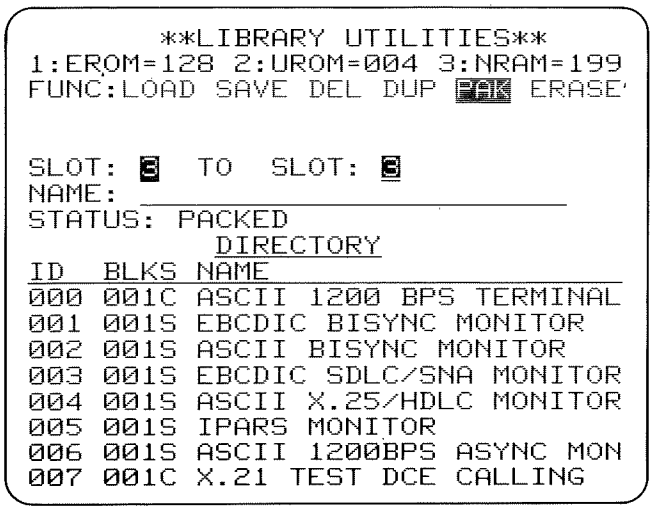


Figure 29-8 Packing a memory card.

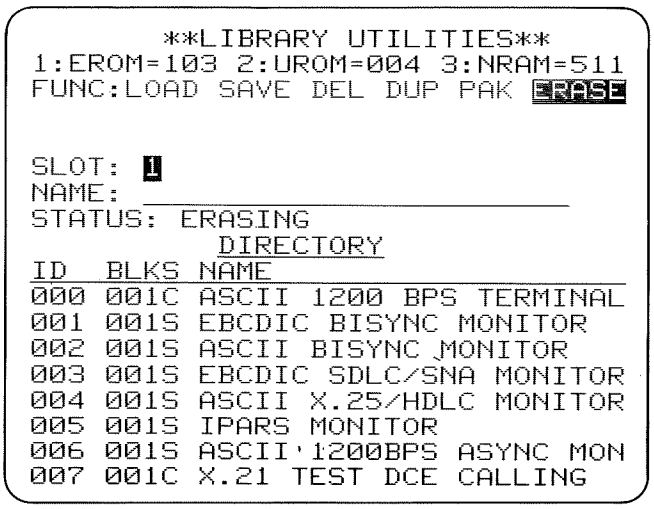


Figure 29-9 Erasing a memory card.

29.4.5 PACK

When an entry is deleted from the directory, the memory is not rewritten, but the "deleted" records are flagged in the memory. Newly saved material is always added at the end of the written area of the memory.

To free the unavailable memory capacity that results from deletions, use the PAcK function (Figure 29-8). This rewrites the memory so that the free blocks are all at the end of memory where they can be used by the SAVE function. To PAcK a card, enter its Slot number in both fields on Line 6.

NOTE: UROM or Write-Protected cards cannot be packed in this manner; that is, onto themselves.

Memory can also be packed from one card to another. In other words, only nondeleted records are copied to the destination card. Enter the Slot number of the memory to be packed in the first field on Line 6, and the Slot number of the card to which it is to be written in the second field. If the destination card already has records stored in it, as many nondeleted records as possible will be copied from the source card and placed at the end of the destination card.

The duplicate entries will be added to the directory. If you wish, you can then ERASE the memory card from which the transfer was made.

NOTE: If you pack a card that has CRT data stored on it, the unit will utilize the CRT buffer in executing the PACK. When the PACK is completed, the buffer will be empty.

29.4.6 ERASE

When you select ERASE (Figure 29-9), one slot number field is shown on Line 6. Enter the number of the card you want to erase and press XEQ. The STATUS line will display ERASING, then ERASED.

NOTE: UROM and Write-Protected cards cannot be erased.

UROM cards cannot be erased in the COMSTATE I. The UROM card must be removed from the slot, and each ROM chip removed from its socket and placed in an ultraviolet eraser for the appropriate length of time. To erase a Write-Protected VRAM or EROM card, set DIP switch S1-8 on the card to OFF (see Section 29.7).

29.4.7 Aborting a Function

Any of the memory functions except LOAD (that is, the write functions) will be aborted if you press the PROGRAM key during its execution. The COMSTATE I will attempt to correct the linked-list error caused by the abort. (See Section 29.5.)

29.5 MEMORY-RECORD MANAGEMENT

Upon entry to the Library Utilities (PROGRAM 9) menu (or the Test Library menu, PROGRAM 8) the COMSTATE I checks the integrity of the linked lists used for record management on each card. The message CHECKING FILE SYSTEM appears momentarily at the bottom of the screen while this is being done.

Linked-list errors are usually caused by an interrupted Save (owing to power failure, PROGRAM key being depressed during the Save, and so on). The next time either Library menu is entered, the unit will attempt to correct the linked list by marking the unfinished record as deleted. If the attempt is successful, the card will be fully usable and the number of blocks available for writing will appear on Line 2 of the Library Utilities menu.

NOTE: The COMSTATE I cannot correct a linked-list error if the DIP switch S1-8 (write-protect switch) on the memory card was turned ON subsequent to the interruption.

If a card is found to be uncorrectable, the number of bytes available will be displayed as "???." This in effect write-protects the card and prevents the failure of subsequent saves. If the error is something other than an unfinished write -- an actual memory hardware failure somewhere in the linked list, for example -- the card will also be unreadable and all its records will disappear from the directory. In either case, the card must be erased before it can be restored to full use.

If a VRAM record error cannot be corrected after a write function to VRAM has been aborted, the VRAM card will automatically be erased when you reenter either Library menu.

29.6 INSTALLING MEMORY CARDS (OPT-21, 22, 24)

CAUTION: Do not exchange memory cards while the power is turned on.

Power-down the COMSTATE I and open the memory-access door on top of the unit to exchange memory cards.

The slot numbers on the adapter-programmer board into which the memory cards are installed correspond to the number displayed on Line 2 of the Library Utilities menu. Work the card you want to replace out of its connectors by lifting one corner, then the other.

Any three memory option cards may be installed; it does not matter what combination of memory types you use or which slots they go in.

The installation procedure is the same for all memory card options.

(1) Turn off the power on your unit.

(2) Check DIP switch set S1 on each memory card against Tables 29-2, 29-3, and 29-4 before you install the card.

(3) Check that the four jumpers next to DIP switch set S1 are correctly installed in accordance with Table 29-3.

CAUTION: If the jumper locations are not correct for the type of memory ICs on the card, or if all memory ICs on the card are not of the same type, circuits on the memory card may be destroyed.

(4) The memory cards and card connectors on the adapter-programmer board are keyed to prevent incorrect installation. Each card must be positioned with its component side toward the right side of the instrument (as you face toward the front panel). Be sure that each card is securely seated in its connector.

TABLE 29-2
MEMORY CARD DIP SWITCH S1 SETTINGS

S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8
Memory Type (See Table 29-3)			OFF	Memory Size (See Table 29-4)		OFF	ON: Write-protected OFF: Not protected

TABLE 29-3
MEMORY TYPE

Switch Settings			Jumper Locations	Meaning	Option Number
S1-1	S1-2	S1-3			
OFF	OFF	OFF	----	Illegal (= No card)	NA
ON	OFF	OFF	4, 5, 8, 11	Volatile RAM	OPT-22-x
OFF	ON	OFF	3, 5, 8, 11	Electrically erasable PROM	OPT-24-x
ON	ON	OFF	2, 7, 10, 13	UV-erasable PROM	OPT-21-x
OFF	OFF	ON	16K header position	Nonvolatile RAM	OPT-23-1
ON	OFF	ON	64K header position	Nonvolatile RAM	OPT-23-2
OFF	ON	ON	----	Undefined	NA
ON	ON	ON	----	Undefined	NA

TABLE 29-4
MEMORY SIZE

Switch Settings			
S1-5	S1-6	Meaning	Option Number
OFF	OFF	Illegal (= No memory)	NA
ON	OFF	16k bytes (128 blocks)	OPT-22-1; OPT-23-1 OPT-24-1
ON	ON	64k bytes (511 blocks)	OPT-21-2; OPT-23-2

29.7 TEST LIBRARY MENU

You may use the Test Library menu (PROGRAM 8) for loading any records listed in the directory -- those on the expansion memory cards as well as the factory-stored internal memory setups. LOAD is the only function that can be performed from this menu, however. (See Figure 29-10.)

29.8 TEST LIBRARY

The Test Library menu is a directory of the tests and setups currently held in the COMSTATE I's memories. You may load any of these tests or setups directly from the Test Library menu.

Display the Test Library menu by pressing the PROGRAM key followed by the numeral 8. The cursor will be in the SLOT field on 0.

The first digit in the ID number of each setup in the directory is the slot number. The second and third digits are the record number. Enter the record number for any setup in the directory in the RECORD field. Then press XEQ. The Test or Setup menu will automatically be loaded in accordance with your selection.

Setups are designated by an "S" after the block number on the menu; Tests are designated by a "T". If the directory is longer than eleven lines, press CONTROL-DOWN or SHIFT-DOWN. CONTROL-UP or SHIFT-UP will return you to the previous page of the directory.

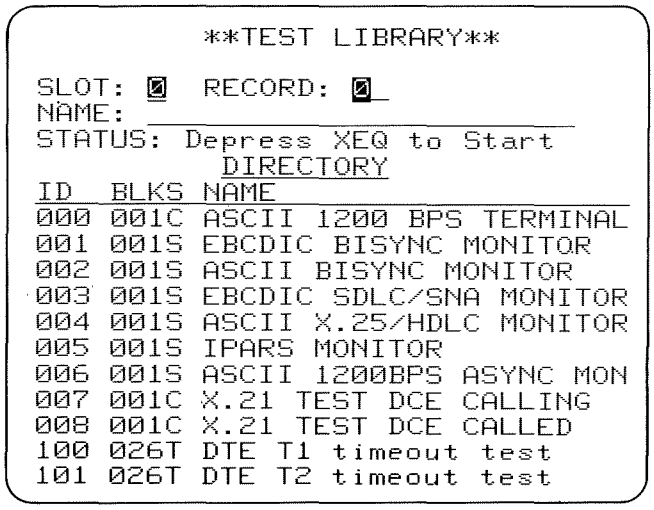

TEST LIBRARY
SLOT: 0 RECORD: 0
NAME:
STATUS: Depress XEQ to Start
DIRECTORY
ID BLKS NAME
000 001C ASCII 1200 BPS TERMINAL
001 001S EBCDIC BISYNC MONITOR
002 001S ASCII BISYNC MONITOR
003 001S EBCDIC SDLC/SNA MONITOR
004 001S ASCII X.25/HDLC MONITOR
005 001S IPARS MONITOR
006 001S ASCII 1200BPS ASYNC MON
007 001C X.21 TEST DCE CALLING
008 001C X.21 TEST DCE CALLED
100 026T DTE T1 timeout test
101 026T DTE T2 timeout test

Figure 29-10

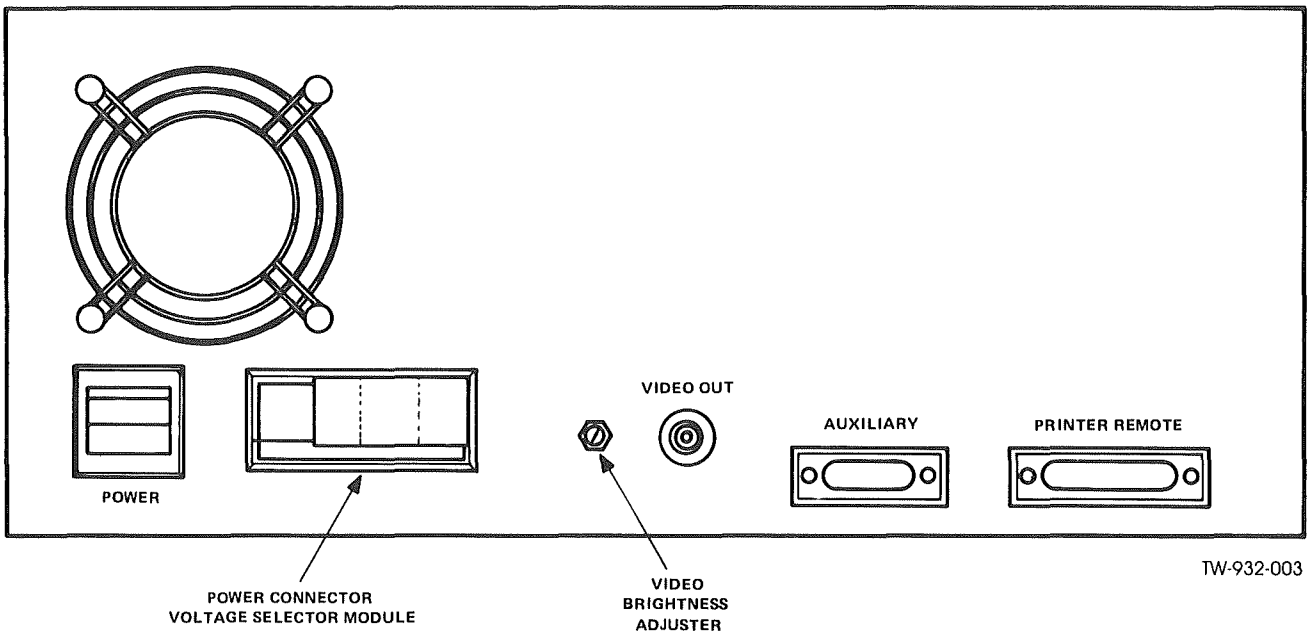


Figure 30-1 Rear panel of COMSTATE I.

TABLE 30-1
PRINTER/REMOTE CONNECTOR

Pin		Lead	Function
2	=	TD	(Data In)
3	=	RD	(Data Out)
5	=	CTS	(Output)
6	=	DSR	(Output)
8	=	RLSD	(Output)
20	=	DTR	(Input)
7	=	GND	(Ground)

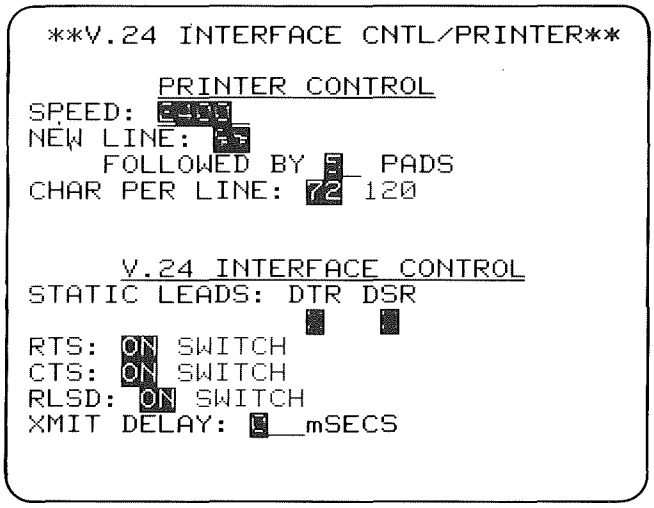


Figure 30-2 The Printer Control menu (PROGRAM 5).

30
PRINTER OUTPUT

The COMSTATE I can print program menus, frozen data displays, or the entire 64-page data buffer on most serial, asynchronous ASCII printers.

30.1 INTERCONNECTION

Connect the serial interface of the printer to the female RS-232/V.24-type PRINTER/REMOTE interface connector on the rear of the COMSTATE I (see Figure 30-1). The COMSTATE I transmits to the printer on Pin 3 (RD). It also drives Pins 5 (CTS), 6 (DSR), and 8 (RLSD) to +12 V (ON). The COMSTATE I monitors Pin 20 (DTR): it will not transmit unless DTR is ON. When DTR goes OFF the COMSTATE I stops transmitting on Pin 3; when DTR comes back on, it resumes transmitting. (See Table 30-1.) Information is transmitted in even-parity ASCII (7 information bits). Your printer should be set to receive information in this format.

30.2 PRINTER CONTROL MENU

The Printer Control menu on the Program 5 display (Figure 30-2) should be filled out before you attempt to print any display.

30.2.1 Speed

Use this data-entry field to match the COMSTATE I to the speed of your printer. The speed is entered in baud using a maximum of five digits, or four digits and a decimal point.

30.2.2 New Line

In this data-entry field insert the carriage-return character or characters needed by your printer. The default characters are the ASCII control characters CR LF.

In the next field, insert the number of pad characters that must follow the carriage return instruction in order to give the printer time to perform the carriage return. The maximum entry is 99; the default is 5.

30.2.3 Characters Per Line

Select the number of printed characters per line. The choices are 72 (the default value) and 120. If the printer's line length is at least 72 characters and less than 120, choose 72. If the printer's line length is 120 characters or more, select 120. The COMSTATE I will not output more than 120 characters per line.

TABLE 30-2
SPECIAL CHARACTER REPRESENTATIONS ON PRINTOUTS

CRT Display	Printout
Alphanumeric (ASCII) characters	Character is preceded by and followed by a space.
Special characters: 7E (Flag), Bit Mask, G or B (BCC), A (Abort), DC (Don't Care)	Character representation (one or two printed characters) is preceded by a colon.
Don't Care	:DC (upper case)
Not Equal (bar through character)	- (dash) precedes character. = (equal sign) replaces the colon preceding special characters.
Control characters	Lower-case mnemonic (displayed as a space followed by two lower-case printed characters)
Hexadecimal characters	Displayed as a space followed by two printed characters
Fill symbols (on dual-line display)	Dotted lines

```
**TRIGGER 1**
MON: DTE
FOR:STG
 sy sy dl sx:M    M:XXXXXXX0
INTERFACE: EIA
RTS CTS DSR DTR RLSD UA ENTR
 X   X   X   X   X   X   X
FLAGS:XXXXXXXX  TIMEOUT: NO
PROMPT:START INFO
TIMEOUT: NO
LOAD NO
    REV FRZ LOW
CRT: X   X   X  DLY STP: YES
FLAGS: SET  XXXXXXX1
TIMER: NO
COUNTER#1  : RESET
ALARM: NO  OUTSYNC: NO
```

Figure 30-3 Printout of menu shown in Figure 30-4.

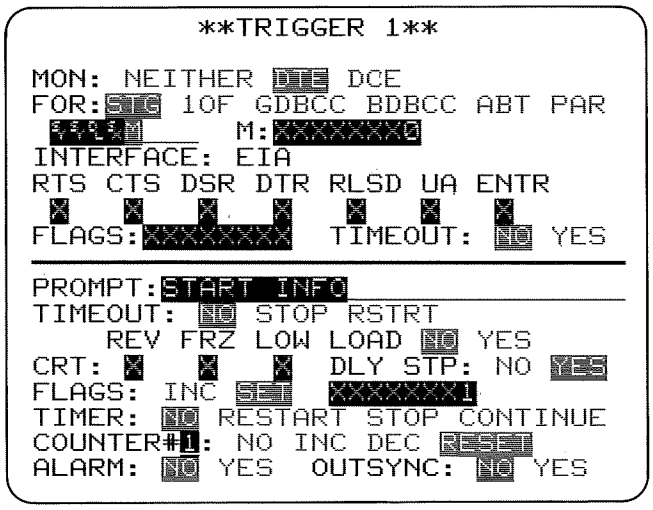


Figure 30-4

30.3 PRINTOUT PROCEDURES

To obtain a printout of any program menu or frozen data display, except Trigger Freeze, fill out the Printer Control menu, display the material to be printed, and press the PRINT key. The display will be printed out.

The COMSTATE I will automatically print all program menus if you press the PRINT key while the Menu Selections screen is displayed. (For this screen, simply press PROGRAM.)

You may also print the entire 64-page data buffer: Press SHIFT-PRINT or CONTROL-PRINT while the COMSTATE I is in Delay Stop, Manual Freeze, or Data Buffer (Program F) mode.

30.4 PRINTED FORMAT

30.4.1 Program Menus

Most program menus can be adequately represented by 72 character-per-line printouts. The printout will correspond 1:1 with most characters on the display. However, each character in a data-entry field is allotted three positions on the printout. This prevents control characters from being read by the printer and allows special characters such as hexadecimal or bit masks to be represented with standard alphanumeric characters. The symbols used for these and other characters are defined in Table 30-2.

Figure 30-3 is a printout of the trigger menu shown in Figure 30-4.

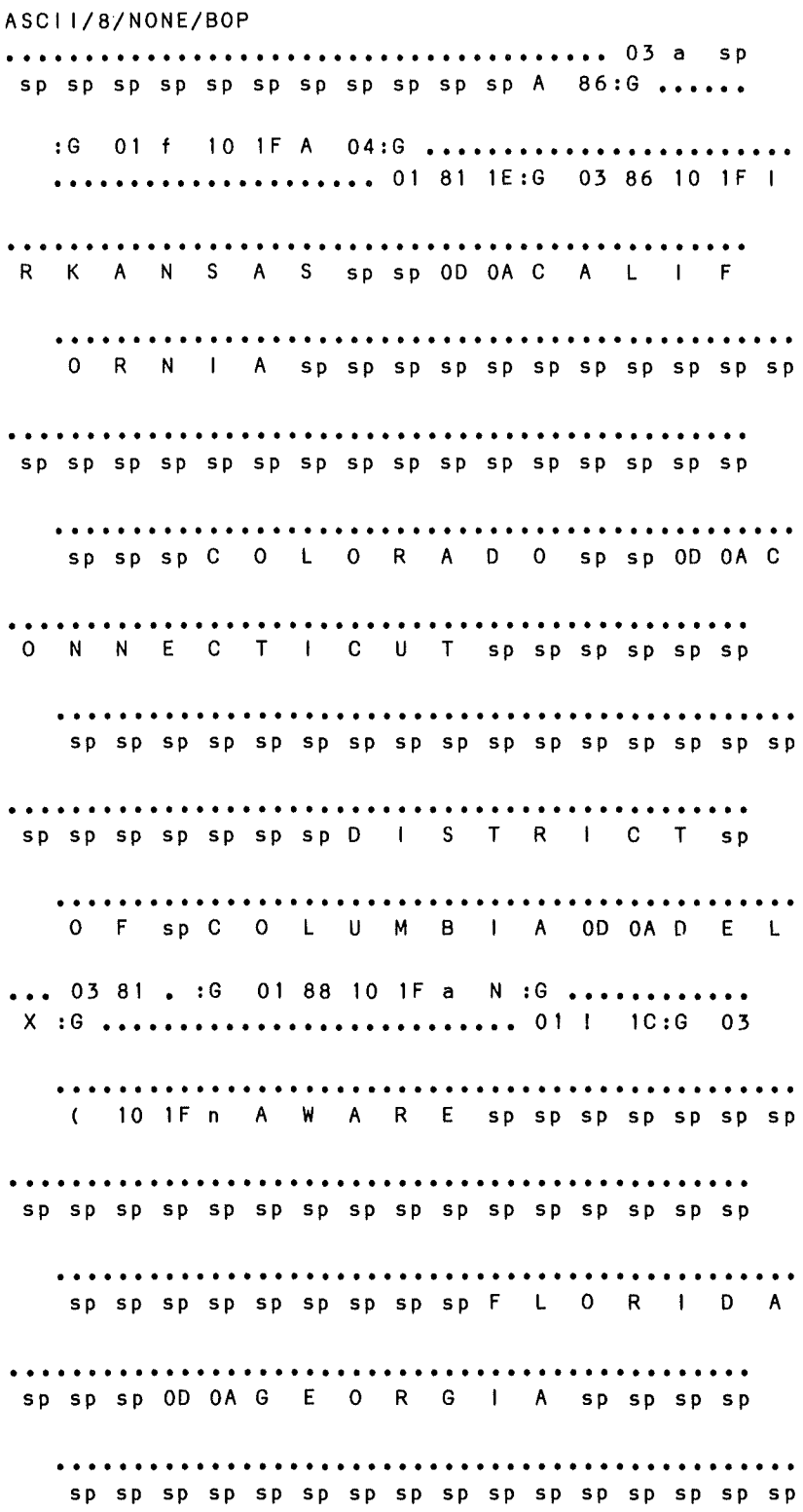


Figure 30-5 Printout of dual-line data display shown in Figure 30-6 (72 characters per line selected).

30.4.2 Data Display

The COMSTATE I can print either single frozen data screens or the entire CRT data buffer when it is in Manual Freeze, Delay Stop, or Data Buffer (Program F) mode. The protocol trace display can also be printed. The COMSTATE I cannot print real-time data or print in Trigger Freeze mode.

(a) Status Lines. The status information on Line 1 will be printed, but the binary character breakdown on Line 2 will not (compare Figures 30-5 and 30-6).

(b) Data. Data is printed without any enhancements. When dual-line display has been selected on the Protocol Setup menu, all data is printed in dual-line format (compare Figures 30-5 and 30-6). If the line length is 72 characters, the wrap-around lines are indented. A line of TD (or T) data is followed by a line of RD (or R) data and then a line feed. Thus, the data line following a blank line is always TD (T) data. Dots replace the L-shaped fill symbols (three dots for each character time).

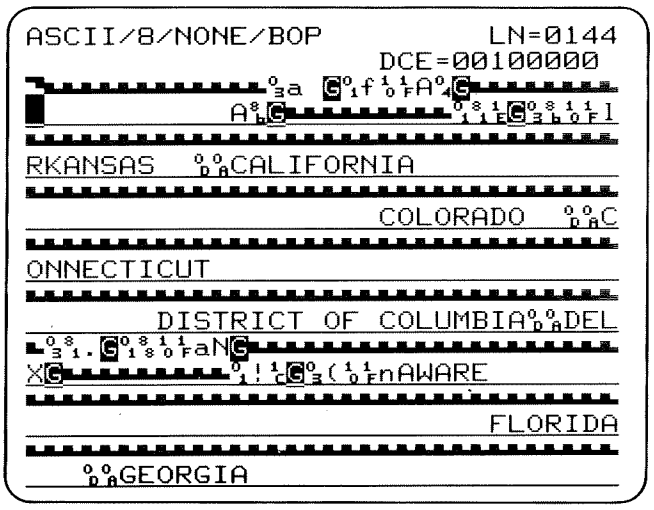


Figure 30-6

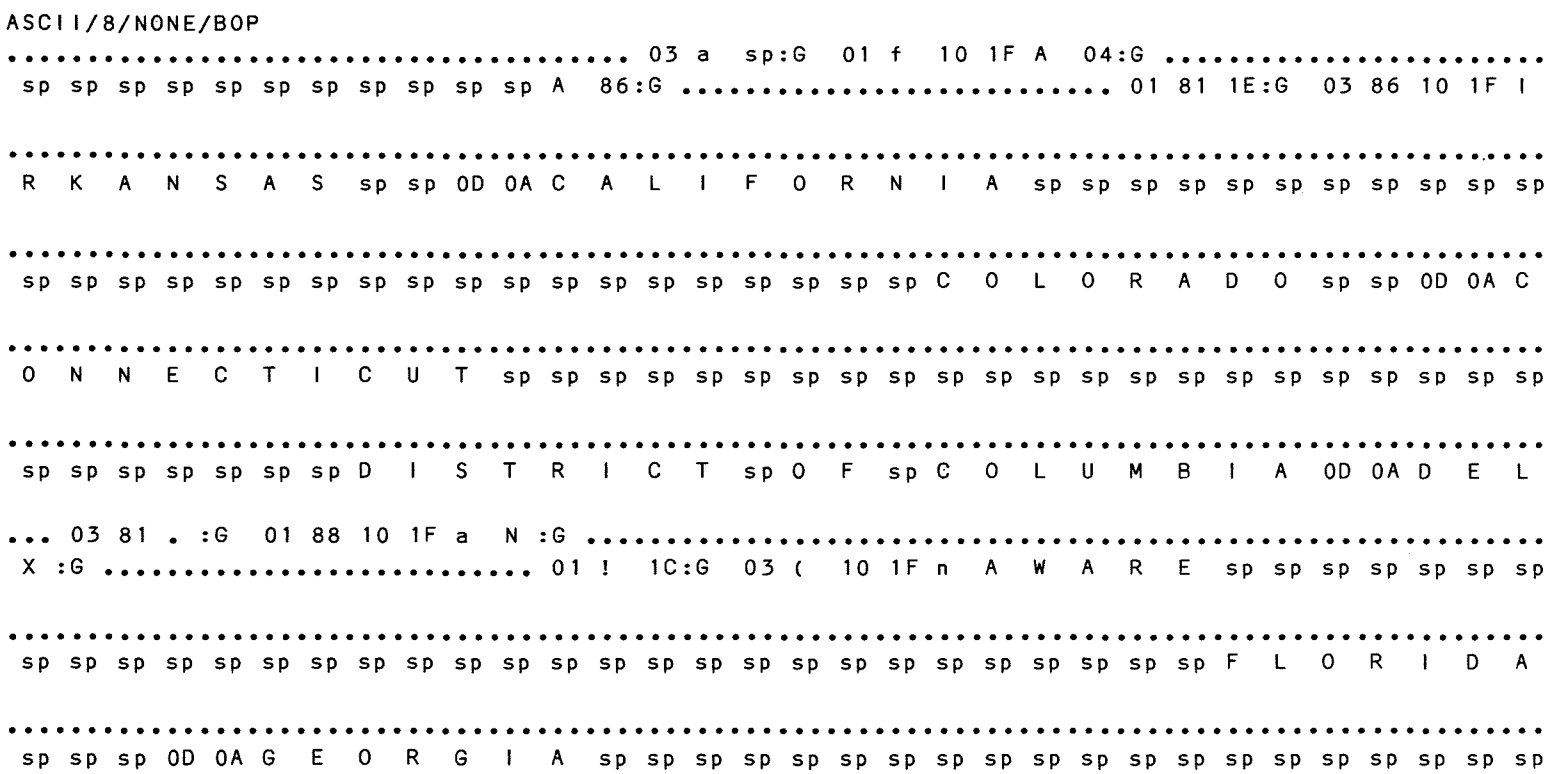


Figure 30-7 At 120 characters per line, printout matches COMSTATE I screen line for line.

NOTE: We recommend that data displays always be printed dual line. In single-line display, the printout does not distinguish between TD and RD data.

The COMSTATE I automatically converts all data to ASCII before it is sent to the printer interface. All characters for which there is no ASCII equivalent are sent to the printer as two-digit hexadecimal numbers.

Each data character is allotted three spaces on the printout to accommodate control characters and hexadecimal. If you select 72 characters per line, therefore, the printout will show only 20 characters per line and will not correlate directly with the CRT display.

If you select 120 characters per line, the printout will correspond line for line with the CRT display (there are 32 characters in a line of the CRT display).

31
REMOTE TRANSFER

Remote Transfer can be used:

- to transfer either a complete test (or setup) or the contents of the data buffer from one COMSTATE I to another;
- to download tests, setups, or data to an INTERVIEW 30B/40B; or to upload tests, setups, or data from an INTERVIEW 30A/40A or 30B/40B;
- to upload tests, setups, or data into tape storage in a current INTERVIEW 3600/4600 or a current INTERVIEW COMSTATE II, via the remote interface and the automatic-transfer mode on the destination device; or to download tests, setups, or data from such tape storage;
- to upload data first onto tape and then into the data buffer in a current INTERVIEW 3600/4600 or INTERVIEW COMSTATE II; or to download the contents of the data buffer (once placed on tape) from one of these devices;
- to dump a test, setup, or data to a recording device with an asynchronous interface; or to load a test, setup, or data from a recording device;
- to emulate a terminal that controls, via Unattended Remote Control, a remote COMSTATE I or 30B/40B.

The PRINTER/REMOTE connector on the rear of the COMSTATE I is used for all these purposes. Two special cables are needed: an INTERVIEW-TO-INTERVIEW cable for direct connection to the Printer/Remote interface on another COMSTATE I, COMSTATE II, INTERVIEW 30/40, or INTERVIEW 3600/4600; and an INTERVIEW-to-Modem cable for connection to an asynchronous modem, to the Monitor port of an INTERVIEW recording device (including INTERVIEW 20R), or to the RS-232 interface of a non-INTERVIEW recording device.

NOTE: The COMSTATE I's Remote Transfer utility will operate with asynchronous modems, but not with synchronous modems.

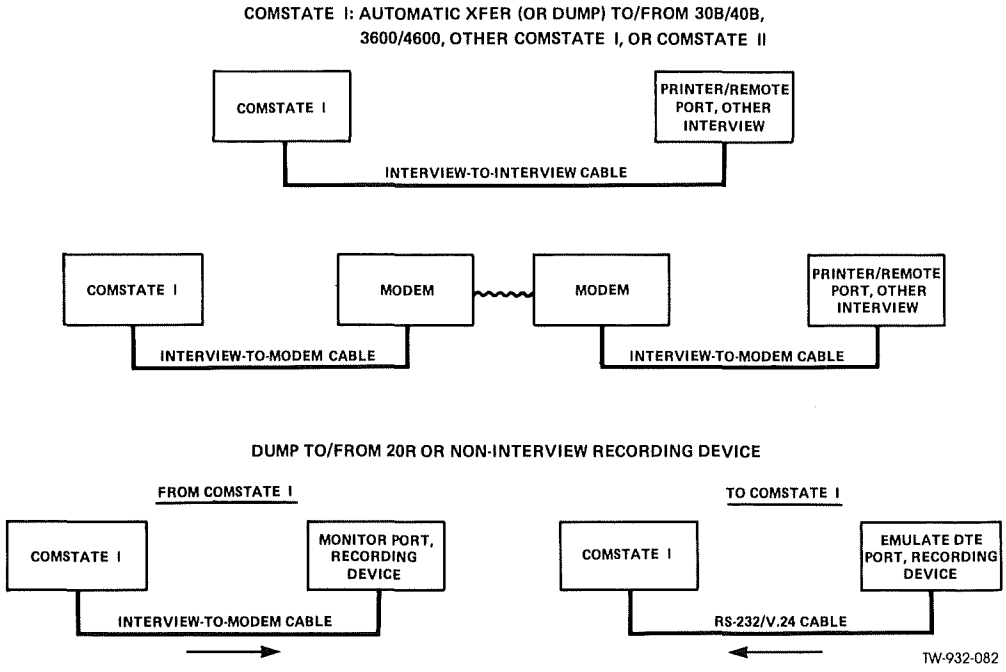


Figure 31-1 Remote transfer applications. Cable is always connected to Printer/Remote connector of the COMSTATE I.

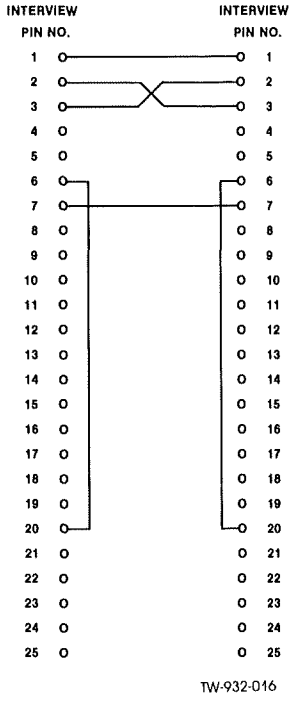


Figure 31-2 INTERVIEW-TO-INTERVIEW CABLE wiring diagram.

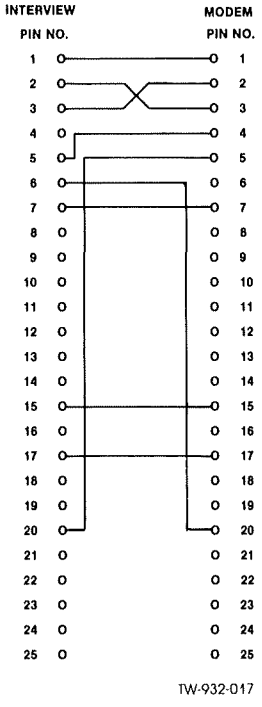


Figure 31-3 INTERVIEW-TO-MODEM CABLE wiring diagram.

31.1 PRINTER/REMOTE INTERFACE AND CABLING

31.1.1 Printer/Remote Interface

The PRINTER/REMOTE interface on the rear panel of the COMSTATE I always appears as a modem. DSR and RLSD are constantly driven ON. When the COMSTATE I is performing a Remote Transfer SEND function, it transmits on Pin 3 (RD) of the Printer/Remote connector. If it is performing the RECEIVE function, it expects to receive on Pin 2 (TD) of that connector. (See Table 30-1 for the PRINTER/REMOTE connector.)

31.1.2 Special Cables

Because the Printer/Remote interface appears as a modem, special cables must be used for the Remote Transfer functions. Refer to Figure 31-1 for applications using these cables. For uploading or downloading from a COMSTATE I to another INTERVIEW (AUTOMATIC operation), use the INTERVIEW-TO-INTERVIEW cable (see Figure 31-2). Connect this cable between the two Printer/Remote connectors.

For uploading or downloading (AUTOMATIC operation) from a COMSTATE I to another INTERVIEW via modems, use the INTERVIEW-to-Modem cable (see Figure 31-3) between each INTERVIEW and its modem.

NOTE: The INTERVIEW-to-Modem cable can be connected in only one direction. Be sure to connect the end labeled INTERVIEW to the Printer/Remote connector, and the end labeled MODEM to the modem.

For dumping to an INTERVIEW 20R or to a non-INTERVIEW recording device, insert the cable-plug labeled MODEM into the RS-232 interface on the recording device. Normally RD data, the COMSTATE I output will be converted by the cable and recorded as TD data, and it will be played back to the COMSTATE I on TD during a RECEIVE DUMP. The INTERVIEW-to-Modem cable is also used for dumping to a recording device through modems.

31.1.3 Handshaking with the INTERVIEW-to-Modem Cable

For the Printer/Remote interface to appear as a terminal, the special INTERVIEW-to-Modem cable (Figure 31-3) must be used. Then, at the MODEM connector of this cable, DTR appears constantly ON. When the XEQ key is pressed while SEND is selected on the Remote Transfer menu, RTS is turned on. (The signals in this description are named as they appear to the modem.) The transmitting unit waits for CTS. It will wait indefinitely for the first CTS. When CTS ON is received, the program or data is transmitted in hexadecimal-encoded ASCII on TD (Pin 2). After contact has been established with the remote unit, the sending INTERVIEW attempts an RTS-CTS handshake after the transmission of each block of data. If it does not receive CTS within one second after it sends RTS, the transfer is aborted and a prompt to that effect is displayed. If CTS turns off before the text block is completed, the COMSTATE I will finish the current block before stopping.

When DUMP is selected, the COMSTATE I will transmit on the Printer/Remote interface immediately without handshaking.

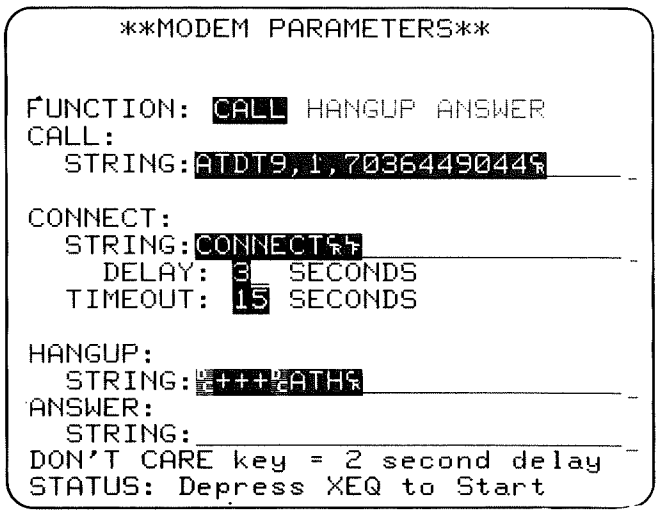


Figure 31-4 Modem Parameters menu (PROGRAM D).

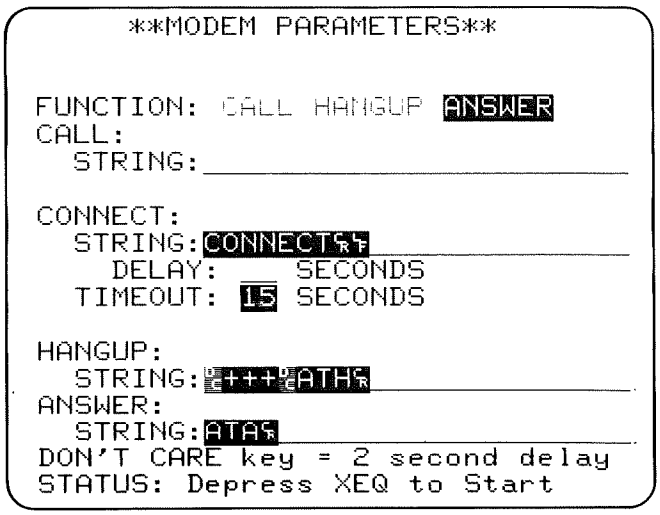


Figure 31-5 Answer String tells local modem to go from voice to data.

31.2 ESTABLISHING REMOTE CONNECTION THROUGH SMART MODEMS

The COMSTATE I has two menu screens devoted to remote-transfer functions, the Program A REMOTE TRANSFER screen and the Program D MODEM PARAMETERS screen. The Program A screen controls the up-loading and downloading of tests and data between INTERVIEWs, as well as the dumping of information to non-INTERVIEW devices. The Program A menu also includes a terminal emulation for data conversation between terminals and for controlling a remote COMSTATE I or 30B/40B. Program A functions are discussed in Sections 31.3 through 31.5.

The present section discusses the Program D Modem Parameters menu screen. Use the Program D screen to establish data communications through an external (or optional internal) intelligent modem.

31.2.1 Program D Modem Parameters Menu

When your PRINTER/REMOTE interface is connected to a smart modem (or when the internal modem is installed), use this menu screen to place, answer, or hang up a call. Enter the parameters on this screen according to the requirements of you local modem; then press XEQ. Figures 31-4 and 31-5 illustrate commands that would be understood by a Hayes Smartmodem 1200. (Note: Smartmodem 1200 is a trademark of Hayes Microcomputer Products, Inc.)

The COMSTATE I's Auto Callback feature enables this screen when there is no operator on hand to press XEQ. Regardless of the selection in the FUNCTION field, the unattended COMSTATE I places a call, transmits a prompt, and hangs up automatically in response to a trigger. See Section 32.6, Automatic Callback.

When the optional internal modem is installed and PORT: MODEM is selected on the Program A menu, firmware coordinates the flow of messages between the COMSTATE I and the modem. Most of the fields on this menu disappear. For the Program D menu as it appears when the internal modem is installed and the phone-jack interface is selected, see Section 33.

31.2.2 Program D Menu Parameters

In the FUNCTION field, select CALL, HANGUP, or ANSWER. Then press XEQ to transmit to the modem one of the strings entered lower down on the screen. Use ANSWER when the connection already is made and you simply want to go from voice to data.

For the CALL STRING, enter the dial-up number of the remote modem. Include whatever dial-command characters your calling modem requires. You may need to embed delays in the call string (9, delay, 1, delay, area code, etc.) for the sake of the PBX and the local switches. DON'T CARE characters inject 2-second delays in the conversation between the COMSTATE I and the modem, not in the string that the modem sends over the line. Consult the modem manual for the proper delay characters.

If you are trying to convert a connection from voice to data and the remote modem is sending an answer tone, enter an Originate command as your Call String. (The Smartmodem 1200 version of this command is ATD<CR>.)

The local external modem sends the CONNECT STRING back to the COMSTATE I after a CALL or ANSWER to confirm that the data-connect handshake has been completed.

DELAY applies to Auto Callback only. See Section 32.6.2.

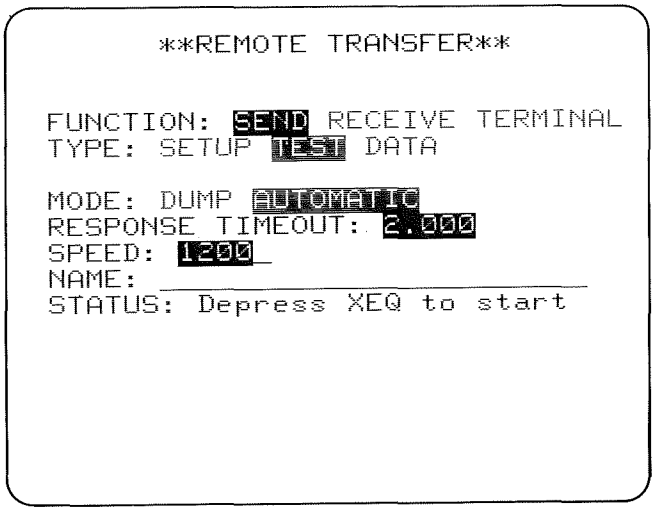


Figure 31-6 Remote Transfer menu (PROGRAM A).

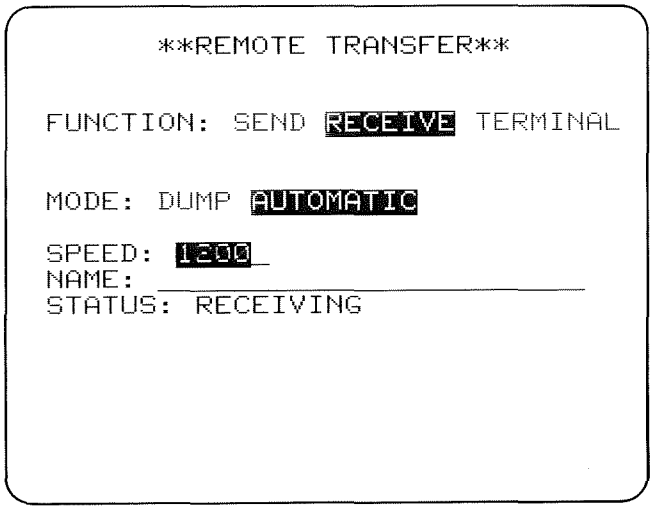


Figure 31-7 Receiving data from a remote device.

TIMEOUT is the time the COMSTATE I will wait for a connect string after sending the call or the answer command. After this timeout, the COMSTATE gives its operator a negative message ("NO ANSWER," for example). A blank TIMEOUT field means the maximum timeout, 65 seconds.

The HANGUP STRING is the series of characters that instructs the modem to hang up.

The ANSWER STRING tells the modem to send an answer tone, even though there is no ring. (An intelligent modem answers a ring automatically.) See Figure 31.5. The answer function is used to convert a voice connection to data.

31.3 UPLOADING AND DOWNLOADING TO ANOTHER INTERVIEW

Once the communications line is established, move to the Program A Remote Transfer menu screen to perform the various remote-transfer functions.

Loading programs to or from another INTERVIEW is accomplished with the AUTOMATIC selection on the Remote Transfer menu (see Figure 31-6). When AUTOMATIC is selected, the INTERVIEWs conduct handshaking (see Section 31.1). The information is transmitted as hexadecimal-encoded ASCII and formatted using a BISYNC protocol subset with error checking (7 bits, even parity, even LRC).

The sending INTERVIEW requests and waits for acknowledgments (ACK0 and ACK1) during the transmission. If no acknowledgment is received within a prescribed time, a response timer times out and the sender transmits an ENQ. After five consecutive ENQs without acknowledgment, the sender aborts the session. The timeout value that precedes each ENQ is selected on the sender's Program A menu. (See Figure 31-6.) This RESPONSE TIMEOUT has a default value of 2 seconds.

31.3.1 Setups and Tests

On the Remote Transfer menu (Program A) of the destination INTERVIEW, select FUNCTION: RECEIVE and MODE: AUTOMATIC. Enter the SPEED (in bits per second) at which the transfer is to proceed. The default value is 1200; the maximum is 9600. Press the XEQ key. On the STATUS line the message RECEIVING will appear, indicating that the unit is ready to receive either a program or data at the Printer/Remote connector. (See Figure 31-7.)

On the Remote Transfer menu of the source unit, select FUNCTION:SEND. In the TYPE field, you may select either:

(1) SETUP. Only the configuration of the Protocol Setup menu (Program 0) and the BCC Parameters menu (Program B) will be transferred.

(2) TEST. The Trigger configurations, Protocol Setup, Interface, Transmit Mode, Interactive Test, and BCC Parameters menus will all be sent.

For MODE, on line 6, select AUTOMATIC. On line 7 enter a SPEED. Be sure that the speed is the same as that selected on the destination unit.

In the NAME field (line 8), you may enter a name for the program you are transmitting. This name will automatically be written on the NAME line in the destination unit. You may use up to 23 alphanumeric or control characters.

Press the XEQ key. The STATUS line will blink the message TRANSMITTING, indicating that the COMSTATE I is ready to transmit the program at the Printer/Remote interface (or through the phone jack, if the modem option is installed).

When handshaking has been accomplished between the two units, or with the modem, a decrementing hexadecimal number will appear at the right of the Status field in each unit. This number is the number of bytes still to be sent or received. When it reaches 00 00 (hex), the download has been accomplished, and the STATUS messages on the source and destination units will change to TRANSMITTED and RECEIVED, respectively.

The program from the source unit will be in the destination unit ready to be run as soon as the RUN key is depressed.

31.3.2 Data

This procedure is the same as for transferring setups and tests except for the following: To load the contents of the data buffer in the source unit into the data buffer of the destination unit, select DATA on line 4 of the Remote Transfer menu, and on line 5 enter the line range that you want to send from the source buffer (see Figure 31-8). The initial value of the hexadecimal number decrementing at the right of the STATUS field during the transfer will depend on the line range selected here.

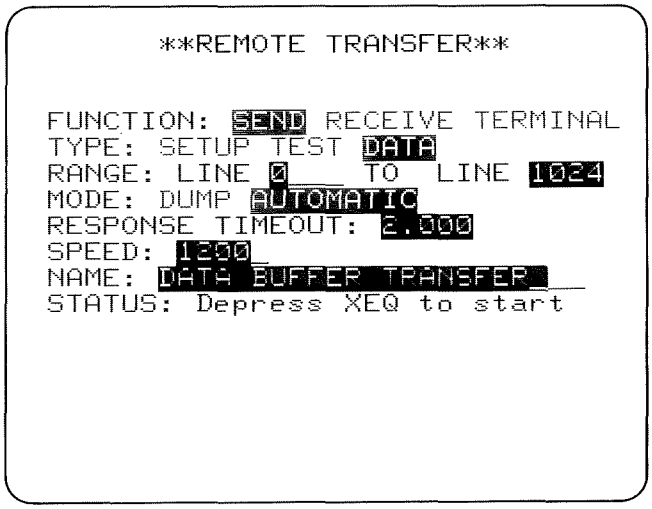


Figure 31-8 Transferring the entire data buffer to a remote device.

The specified data will be loaded into the data buffer of the destination unit beginning at line 0. As soon as RECEIVED shows in the STATUS field of the destination unit, the operator may view the data by pressing PROGRAM, F. The data in the destination buffer will be overwritten each time a data transfer is received.

NOTE: The line number at the top of the data-buffer screen at any given time is the number of the top line on that screen, not the bottom line nor the line with the cursor. To transfer all data on that screen, add 16 to the line-number value that is displayed.

31.3.3 Aborting a Transfer

During a transfer, all keys except the PROGRAM key are illegal on both the source and the destination unit. The transfer cannot be restarted until it has been aborted.

To abort a transfer of any type from the source COMSTATE I, press the PROGRAM key during the transfer. On the source unit, the Menu Selections menu will be displayed; on the destination unit, the STATUS line will blink TRANSMISSION ABORTED.

To abort a transfer when you are at the destination unit, press PROGRAM during the transfer. On your unit, the Menu Selections screen will be displayed. On the source unit -- after a brief delay -- the STATUS message NO RECEIVER RESPONSE will blink.

Whichever unit aborts the transfer, the program in the destination unit before the aborted transfer will not be disturbed. When a Data transfer is aborted, however, the Data Buffer in the destination unit will be overwritten up to the location at which the transfer was aborted.

31.4 DUMPING

The DUMP selection allows the COMSTATE I to transfer data to recording devices that do not use the BISYNC protocol subset that the COMSTATE I and other INTERVIEWs employ at the Printer/Remote interface in Automatic mode.

When DUMP is selected on the Remote Transfer menu, the transfer takes place immediately when the XEQ key is depressed, whether or not the COMSTATE I is linked to the recording device. It does not request or wait for acknowledgments.

NOTE: When a record is DUMPed back to the COMSTATE I from a recording device, the first byte of the record header must be the first thing received after the synchronization characters; otherwise, the COMSTATE I will be unable to use the record. This should be taken into consideration when the program or data is being recorded.

31.4.1 Dumping to a Local Recording Device

Either data or a program may be dumped to a recording device. If the recording device is an INTERVIEW 3600/4600 or COMSTATE II, the DUMP will use the same cables and interfaces as those prescibed for Automatic Transfer in Section 31.1.2 and Figure 31-1. Normally, however, you would conduct automatic transfers rather than dumps with these units.

If the recording device is an INTERVIEW 20R or if it is not an INTERVIEW, connect the COMSTATE I to the device with the INTERVIEW-to-Modem cable, as explained in Section 31.1.2. (The 20R is in this category because it does not accept COMSTATE I tests or CRT data through its REMOTE port.)

On the Remote Transfer menu, select FUNCTION: SEND, the TYPE of information to be sent, and MODE: DUMP. In this mode, the RESPONSE TIMEOUT is the time that the COMSTATE I pauses between block transmissions. The default setting is 2 seconds. Use this selection to control the flow of data in a dump.

NOTE: If you clear this field or enter a setting of zero, the response timeout will revert to the maximum 65 seconds.

Enter a SPEED corresponding to that of the recording device, and a NAME. Set up the recording device to expect asynchronous data with the following characteristics: ASCII, 7 bits, even parity, even LRC, no clock supplied. The speed must agree with that entered on the Remote Transfer menu. Start the recording device; then press the XEQ key on the COMSTATE I.

NOTE: Make sure that the first byte dumped is recorded, so that when the recorded program or data is played back, the COMSTATE I can read the record header correctly.

During the transfer, the hexadecimal number of bytes remaining to be transferred will be decrementing at the right of the STATUS field. When the transfer is complete, this number will read 00 00; then the Status line will display TRANSMITTED.

If viewed on the recording device, the program or data will not be intelligible since the data stream is in hexadecimal-encoded ASCII. However, the NAME of the program or data will be sent in clear text at the beginning of each dump so each record can be clearly identified.

31.4.2 Dumping from a Local Recording Device to the COMSTATE I

Connect the recording device to the COMSTATE I's Printer/Remote interface using a standard RS-232/V.24 cable (see Figure 31-1). Using the same data parameters itemized in Section 31.4.1, set up the recording device to play back data to the COMSTATE I on Pin 2 (TD). The recording device must not embed parity or block check characters during playback.

On the Remote Transfer menu, select FUNCTION: RECEIVE and MODE: DUMP. Be sure the playback speed is the same as the SPEED selected on the Remote Transfer menu.

Press the XEQ key; then start playback from the recording device.

31.4.3 Dumping to (and from) a Recording Device Through Modems

Connect the COMSTATE I to the modem with the INTERVIEW-to-Modem cable (see Figures 31-1 and 31-3). You may require a breakout box in between the recording device and its modem. The recording device must first of all perform interface handshaking with the modem. Then, after it has received the dump as RD data, the device must turn around and transmit the recorded data on TD.

The recording device must begin recording before the XEQ key is depressed. When the COMSTATE I is receiving a dump record there should be no protocol embedded in the record by the communication system, and the COMSTATE I should not receive any data before the first byte in the record.

31.4.4 Aborting a Dump

During a dump, all keys except PROGRAM are illegal. The transfer cannot be restarted until it has been aborted.

To abort a transfer of any type from the COMSTATE I, press the PROGRAM key during the transfer. This will display the Menu Selections menu, and stop the transmission.

A dump cannot be aborted by the destination device. If the destination device ceases to receive or record, or if the link between it and the COMSTATE I is broken during the dump, the COMSTATE I will continue to transmit, as indicated by the STATUS message TRANSMITTING on its Remote Transfer menu.

31.5 FUNCTIONING AS AN ASYNCHRONOUS TERMINAL

The COMSTATE I can function as an asynchronous dumb terminal through its Printer/Remote port (or, if the optional internal modem is installed, through the special phone-jack interface at the rear of the unit). Acting as a terminal, the unit can control the programming of a remote unattended COMSTATE I or INTERVIEW 30B/40B. The operator at a COMSTATE I that is linked to another COMSTATE I (or 30B/40B) through the respective Printer/Remote (or special modem) ports has total control of the keyboard of the remote unit, and can complete both ends of any type of remote transfer without leaving the Program A menu.

31.5.1 Two Terminal Modes

There are two separate Terminal modes in the COMSTATE I. One of them is described in Section 28 of this manual. The Terminal mode described there is selected on the Program 6 menu, and uses the RS-232 connector on the front panel of the unit. Because it uses the front-panel interface, this Terminal mode is under Program 0 control, and all triggers and enhancements are operative.

The Terminal mode on the Remote Transfer screen is a different terminal emulation. It uses the Printer/Remote port (which emulates a DCE). (This terminal emulation may also use the optional internal-modem port.) Triggers and enhancements are inoperative. No Program 0/Program 6 setup is needed.

Certain key-functions are also different in the remote-transfer Terminal mode. In other modes, including Program 6 Terminal mode, the dark blue keys on the COMSTATE I keypad have an internal, cursor-control function. They do not produce signals on the data line. In Program A Terminal mode, these keys transmit control characters over the data line. In this way they control the cursor of the remote COMSTATE I. (See the table in Section 32.)

To scroll through the local CRT buffer in Program A Terminal mode, press SHIFT UP/DOWN ARROW.

To enter this Terminal mode, select TERMINAL on the Program A menu. Select CONVERSATION: NO or YES. Then press XEQ.

If the remote unit is also in Terminal mode, then the two units are in direct keyboard communication. Every key you press, including control characters, will appear on the other screen. An operator at the remote device also can communicate directly to your screen. But without a local echo, you cannot see your own messages, nor can he see his. Select CONVERSATION: YES to supply this local echo, along with an automatic linefeed for every carriage return received or transmitted.

31.5.2 Terminal Mode and Unattended Remote Transfer

Unattended Remote Control of a COMSTATE I by a dumb or ANSI terminal is explained in detail in the next section of this manual. Here we simply will give an example of how a COMSTATE I under remote-terminal control might be made to perform a sequence of remote transfers.

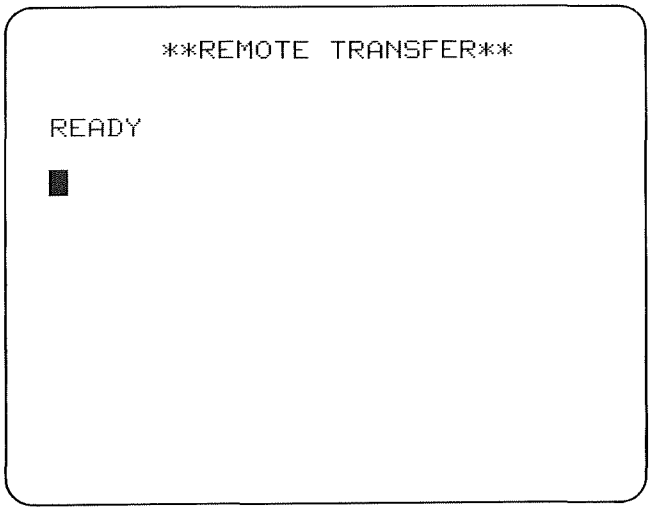


Figure 31-9

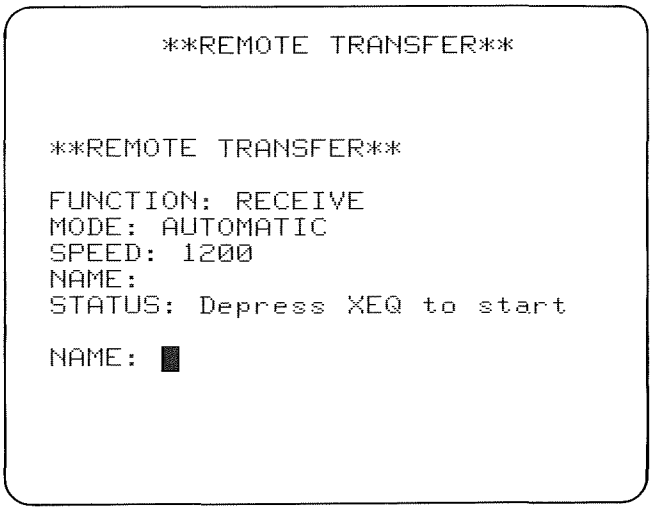


Figure 31-10

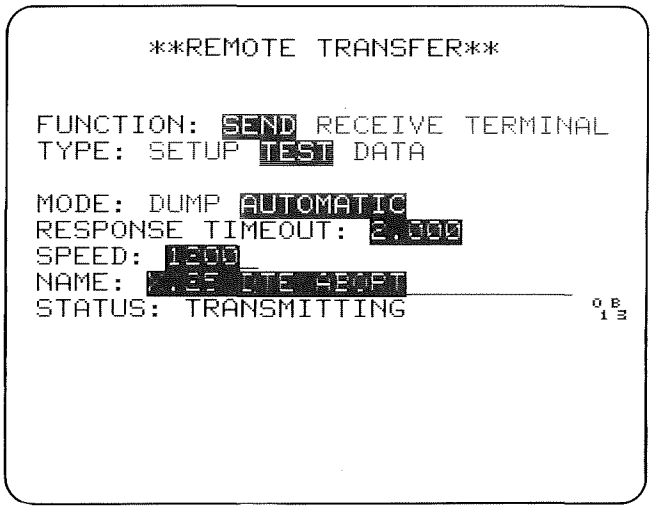


Figure 31-11

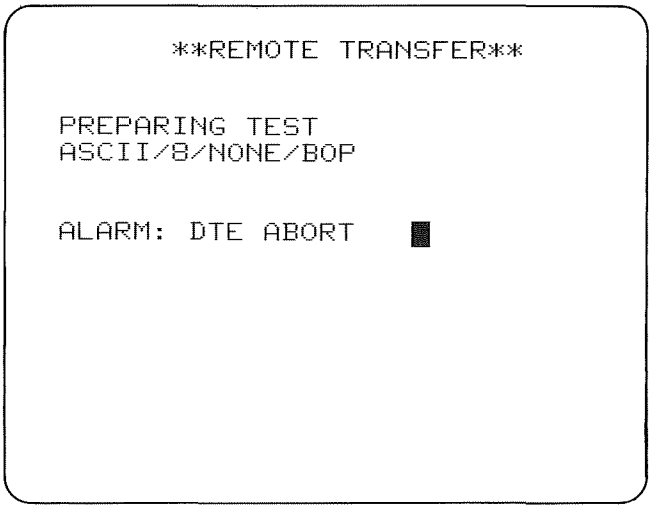


Figure 31-12

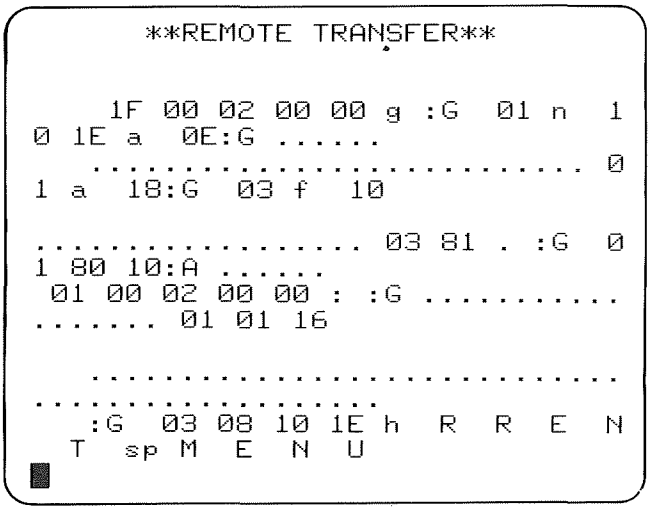


Figure 31-13

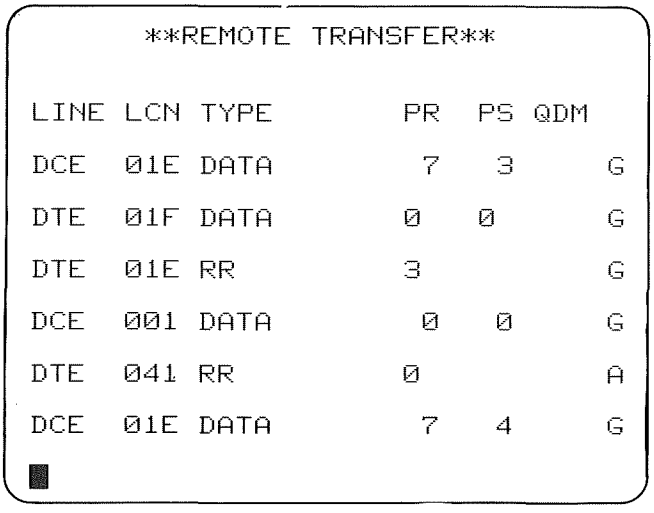


Figure 31-14

In this example, an unattended COMSTATE I is connected via one of its front-panel interfaces to an X.25 data line, and via its Printer/Remote interface to a remote COMSTATE I. The operator at the remote COMSTATE I wishes to test the DTE side of the X.25 line for aborts. He proceeds in these steps:

(1) First he loads a trigger program, entitled "X.25 DTE ABORT," into his own unit from expansion memory.

(2) He selects TERMINAL mode on his own Program A menu, and presses XEQ. He presses CTRL-@ to "attach" the remote unit, which responds with CR, LF, "READY." See Figure 31-9.

(3) The operator then puts the remote COMSTATE into Program A, and orders it to receive an automatic transfer. See Figure 31-10.

(4) Next he selects SEND on his own Program A and begins to transfer the "Abort" program. See Figure 31-11.

(5) When the transmission is completed, the operator sends the remote unit into RUN mode.

(6) When an abort occurs on the DTE line that is being monitored, the remote operator hears an alarm and reads a prompt. See Figure 31-12.

(7) Now he sends a simple command that displays on his own screen the end of the remote unit's data buffer. He also reads a packet-trace display and a statistics screen. See Figures 31-13, -14, and -15.

(8) Finally, he commands the remote unit to transfer its entire data buffer. Figures 31-16 and 31-17 show the operator's own view of the send and receive functions.

(9) The data leading up to the abort is in the operator's own data buffer, where it is available for Reanalyze-mode testing. See Figure 31-18.

```
        **REMOTE TRANSFER**

           **STATISTICS**

       PROGRAM STATE =    0

       COUNTERS:
              #1 DTEpak   0540
              #2 Aborts   0001
              #3 BadFCS   0000
              #4 DISCs    0000


       TIMER:      0000

COUNTERS:
#1 DTEpak
```

Figure 31-15

```
        **REMOTE TRANSFER**


**REMOTE TRANSFER**

FUNCTION: SEND
TYPE: DATA
RANGE: LINE 0
TO  LINE 1024
MODE: AUTOMATIC
RESPONSE TIMEOUT: 2.000
SPEED: 1200
NAME:
STATUS: Depress XEQ to start

TO  LINE 1024
```

Figure 31-16

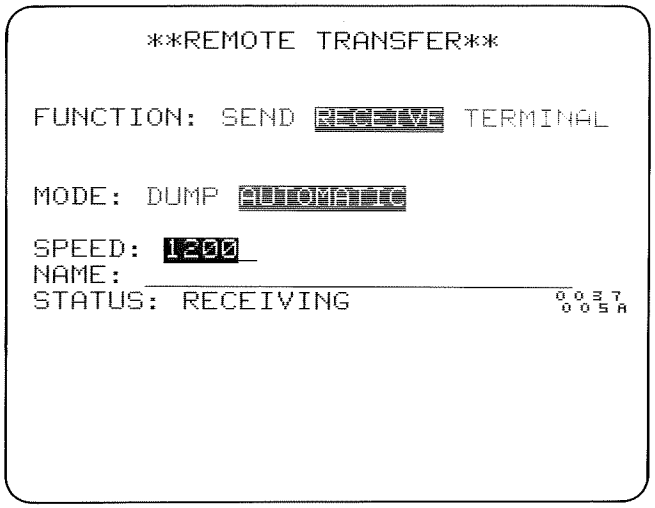


Figure 31-17

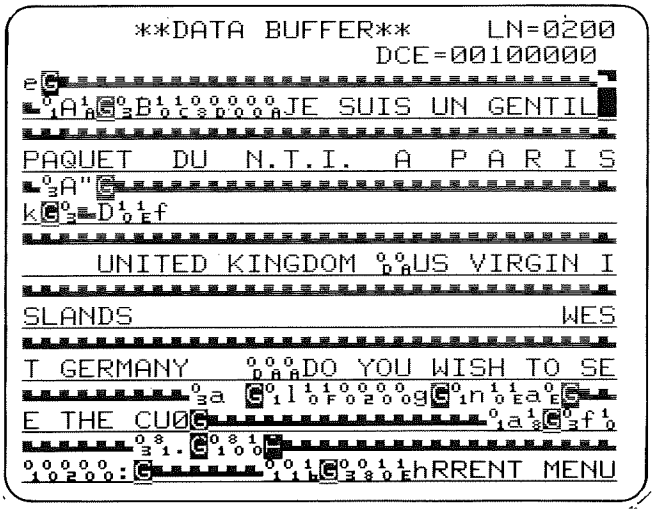


Figure 31-18

32
UNATTENDED REMOTE CONTROL

Functions that can be commanded by an operator at a COMSTATE I keyboard can also be controlled remotely (via modems) from a "dumb" or an ANSI terminal or from another COMSTATE I in Terminal mode. This includes remote-transfer features. An operator at a remote terminal can program a test, run it, and then access the COMSTATE I's data buffer, statistics screen, and BERT screen. He also receives real-time feedback (prompts and alarms) while the test is running. In addition, the COMSTATE I will react to an alarm trigger by dialing a call to a remote terminal.

Most async terminals will control a COMSTATE I successfully. To do so, a terminal should meet these criteria:

(1) It should send a BREAK of 100 milliseconds or longer.

(2) If it is configured to check parity, it should be set to 7 data bits, space parity.

(3) It must not respond to a BS (backspace) control character by backspacing, then deleting. It can respond in this way to a DEL (delete) control character.

(4) There must be no local echo.

(5) It should not perform a linefeed automatically whenever it sees a carriage return.

(6) CTRL S on the terminal keyboard should transmit an XOFF (Device Control 3 or DC3) control character. The COMSTATE I will stop transmitting when it receives this character. It will not respond to DTR going down.

32.1 ATTACHING AND DETACHING

If a COMSTATE I has been connected through its PRINTER/REMOTE port to a modem (via the INTERVIEW-to-Modem cable), once the unit is powered on it can be controlled remotely by an operator at a remote dumb/ANSI terminal or at an INTERVIEW in Terminal mode. (Current versions of the 30B/40B, 3600, 4600, COMSTATE I, and COMSTATE II have Terminal mode.) For a description of the COMSTATE I's Program A Terminal mode, see Section 31.5.

Once the communication line is established, the operator attaches the unattended COMSTATE I by depressing the BREAK key on the remote terminal. BREAK on a COMSTATE I is CTRL Backslash (or @). See Table 32-1 for other keystroke conversions.

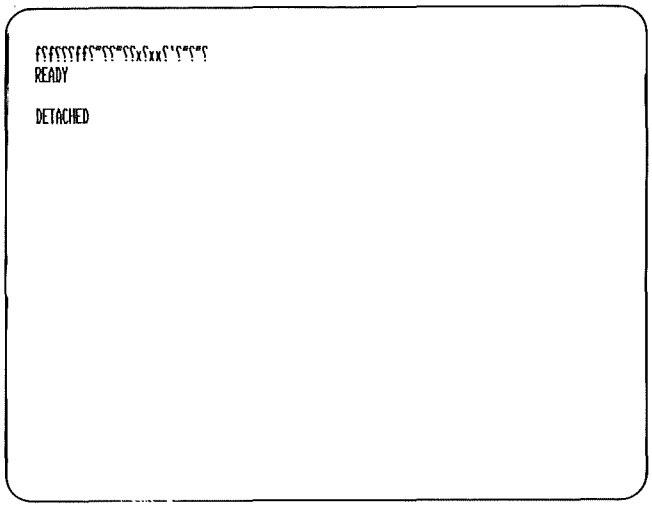


Figure 32-1 Attaching/Detaching an Unattended COMSTATE I.

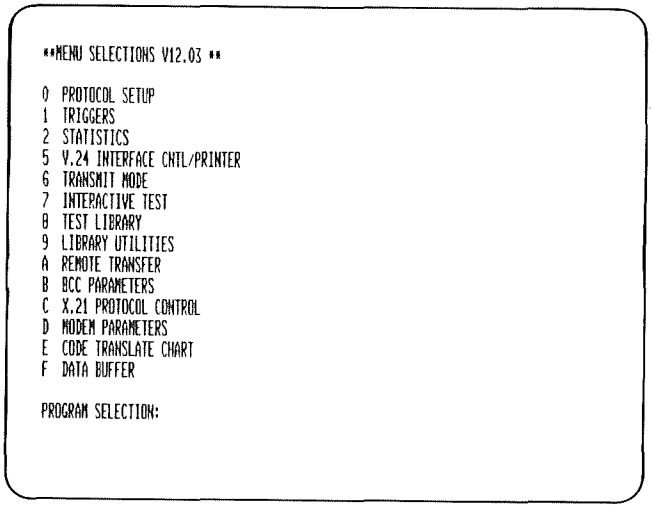


Figure 32-2 Menu Selections screen displayed on remote terminal.

The unattended COMSTATE I responds to the BREAK signal by returning CR-LF, "READY," CR-LF, in ASCII asynchronous format with no parity, at the current data speed. At power-up, the default speed is 1200 bits per second. If the remote terminal is not set at 1200 baud, the message appears as garbage. The operator presses BREAK again to change the speed of the unattended COMSTATE I. The speed will change in this sequence: 1200, 300, 9600, 4800, 2400, 1200, and so forth. When the operator receives the "READY" message, he stops using the BREAK key. Another BREAK at this point would alter the speed of the unattended unit, and another cycle of BREAKs would be required to find the right speed again.

Once the COMSTATE I has found the correct speed and the operator has moved the unit into Program or Run mode, the first BREAK command will simply attach or reattach the remote device at the current speed. (The second BREAK will alter the speed.) After the COMSTATE has adjusted its speed to the external modem, it performs its normal routine of attaching and detaching without having to search again for clock speed.

To detach from an unattended COMSTATE I, press ESC, D. See Figure 32-1.

NOTE: The PRINTER/REMOTE port has two speed controls. One is the BREAK signal described above. The other control is the SPEED field on the PRINTER CONTROL menu, Program 5. When the remote operator detaches from the COMSTATE I, the Program 5 speed selection takes effect until the next BREAK signal. If the remote operator has not detached properly, an operator on site who tries to make the COMSTATE I communicate with a printer will not be able to gain control of the data speed without first powering down the unit or executing an auto-detach command.

The auto-detach command is the key sequence PROGRAM, CTRL CLEAR.

32.2 PROGRAM MODE

Once a remote session has begun, the operator calls up menu screens and makes menu-field selections much as if he were at the keyboard of the unattended unit. To bring up the Program 0 (Protocol Setup) menu, for example, he presses ESC, P (to represent the PROGRAM key on the unattended COMSTATE I) and then 0. To bring up the Trigger 3 menu, he presses ESC, P, 1, 3, just as on the unattended unit he would have pressed PROGRAM, 1, 3.

To display a summary of the COMSTATE I menu screens, press ESC, P, CTRL A. See Figure 32-2.

When a menu screen is called up, the title of the menu is displayed, along with the current selection in the field that has the cursor. (The first field will always have the cursor when a menu is entered.) As the cursor on the unattended unit is moved down the menu by remote commands, the current selection in each successive field is displayed on the remote terminal. Use the various cursor-control commands detailed in Table 32-1 to move the cursor from field to field and to change selections within a field.

NOTE: When you are attached, any menu entries made from the COMSTATE I's keyboard are echoed to the remote terminal. The terminal and the COMSTATE I move in tandem, regardless of where the command originates.

NOTE: The unattended COMSTATE I will not operate as a Program 6 terminal.

To view an entire menu, go to that menu and press CTRL A. At the bottom of the display, the field that contains the cursor is repeated and made available for modification. See Figure 32-3. Only the current selection in each field is presented in this full-menu display. To view alternative selections, roll through the rotating selections in each field. These alternative selections are pictured and described throughout this manual, and they are also easy to reference in our Operator's Field Reference Guide to the INTERVIEW COMSTATE I, ATLC-107-932-104.

To begin monitoring the data line connected to the unattended COMSTATE I, go to the Protocol Setup screen (press ESC, P, 0) and select AUTOMON in the first field on the menu. Go into Run mode by pressing ESC, R. When the COMSTATE I has evaluated a sample of the data and configured itself automatically, it will transmit to you the results of its auto-configuration. See Figure 32-4. At the same time, it begins monitoring data and loading the data into its buffer, where you can view it later by moving to the Program F display.

32.3 XEQ COMMANDS

The Library Utilities option can be useful to an operator who is programming an unattended COMSTATE I. He can load a program remotely, then save it to the unattended unit's expansion memory. See Section 29 for an explanation of the EXECUTE functions on the Program 9 menu.

Some of these functions can take several seconds or even several minutes to be completed, especially when they involve EEROMs and UV-EROMs. (See Table 29-1, Execution Times for Library Functions.) After sending a Program 9 XEQ command to an unattended COMSTATE I, the operator should avoid sending any other commands until a status message indicating that the function has been completed (LOADED, ERASED, DUPLICATED, and so forth) has been returned to the terminal. When a memory function is interrupted, the information on the card may be made permanently inaccessible.

```
**TRIGGER 1**

MON: NEITHER
INTERFACE: EIA
RTS CTS DSR DTR RLSD UA ENTR
 X   X   X   X   X   X   X
FLAGS:XXXXXXXX
TIMEOUT: NO
PROMPT:
TIMEOUT: NO
LOAD NO
   REV FRZ LOW
CRT: X   X   X
DLY STP: NO
FLAGS: SET
XXXXXXXX
TIMER: NO
COUNTER#1
: NO
ALARM: NO
OUTSYNC: NO

FLAGS:XXXXXXXX
```

Figure 32-3 CTRL A displays entire menu. Cursor-field is repeated at bottom.

```
READY


PROGRAM SELECTION:

**PROTOCOL SETUP**

MODE:  AUTOMON
ASCII/8/NONE/ASYNC/1
```

Figure 32-4 Results of auto-configuration are displayed for remote operator

32.4 RUN MODE

Press ESC, R, to enter Run mode.

The COMSTATE I in Run mode does not attempt to send a real-time display of live data to the operator at a remote terminal. There are several reasons for this. For one thing, the front-panel RS-232 or V.35/X.21 interface and the Printer/Remote interface are not likely to be running at the same speed. For another, the Printer/Remote interface uses three characters to represent a single character on the COMSTATE I CRT screen. This allows the INTERVIEW to send special characters ("SY," for example, or "03" for hex 03) to the terminal. A third reason is that in Run mode, in order to maximize processing power, the COMSTATE I must avoid unnecessary overhead.

To view the data, normally the operator leaves Run mode and brings up the Program F data-buffer display. (See Section 32.5.) The operator can interact with the unattended unit and receive important feedback even during Run mode, however.

For example, during a monitoring run or an interactive test the operator can read the unattended unit's current CRT screen by pressing F. This key effects a FREEZE on the unattended unit. When the operator presses the F key again, the CRT, triggers, and test activity are "unfrozen."

Or the freeze that sends the current screenful of data to the remote terminal can be put under trigger control. (The trigger-action field that causes a freeze is DELAY STOP.) In an X.25 environment, the operator might, for example, program a Delay Stop whenever the COMSTATE I encounters a Clear request. From the data sample in Figure 32-5, it would appear that the Clear request was simply the result of an operator in the network logging off.

A Delay Stop interrupts program activity. To have this activity resume, the remote operator presses the F key.

The operator presses T (for "tally") for a real-time reading of the four counters and the timer that are under trigger control. See Figure 32-6.

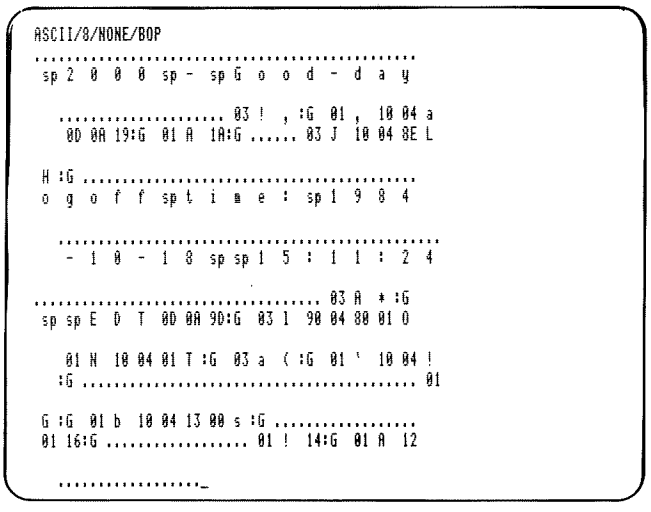


Figure 32-5 A Delay Stop triggered by a Clear request has sent this freeze display to the remote terminal.

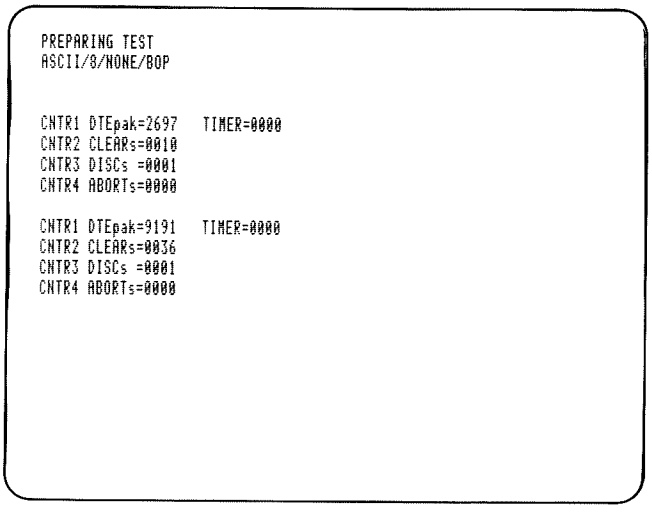


Figure 32-6 The operator has taken two "tallies" of the Statistics screen during a test.

```
  ERRORED SECONDS          0

  NUMBER OF FAULTS         0

BIT ERROR INTRODUCED


  TEST SECONDS           146

  BLOCKS SENT            223

  BLOCKS RECEIVED        223

  BITS IN ERROR            1

  BLOCKS IN ERROR          1

  ERRORED SECONDS          1

  NUMBER OF FAULTS         0
```

Figure 32-7 The operator has injected a bit error into a BERT test.

```
PREPARING TEST
ASCII/8/NONE/BOP


ALARM: DTE Message Aborted  _
```

Figure 32-8 The operator receives a real-time alarm and prompt from the unattended COMSTATE.

```
sp 1  5  sp sp T  R  0  U  8  L  E  sp R  E  P

   ..............................................
    0  R  T  I  N  G  sp P  R  0  C  E  D  U  R  E

.................. @3 !  $ :G ...... @1 $  10 04
 S  0D 0A 6 :G  @3 8  10 04 N  sp 1  6  sp sp T

    a  *  ...:G ....................................
    W  X  sp P  U  B  L  I  C  sp D  I  A  L  sp P

..............................................
 0  R  T  sp N  U  M  B  E  R  S  0D 0A 9 :G  01

    @3... A  *  :G  01 F  10 04 01 b :G .............
    a  10:G ... @3 d  10 04 #  N  o  sp m  o  r  e

............. @3 a  sp:G ... @1 h  10 04 !  q :G
 00 0D 0A $ :G  01... 81 1E:G ................ @1

   ..............................................
    !  1C:G  @3 &  10 04 B  i  N  e  t  :  sp 00 99
```

Figure 32-9 Each data character is allotted 3 spaces in the remote data-buffer display.

```
ASCII/8/NONE/BOP


LINE ADR TYPE       NR  NS P/F
DTE  01  INFO       5   6   0  G
DCE  03  INFO        6   5  0  A
DTE  03  RR         6       0  G
DCE  03  INFO        7   6  0  G
DTE  01  INFO       6   7   0  G
DTE  03  RR         7       0  G
DTE  01  INFO       7   0   0  G
DCE  01  RR          0      0  G
DTE  01  INFO       7   1   0  G
DCE  01  RR          1      0  G
DCE  01  RR          2      0  G
DCE  03  INFO        2   7  0  G
DTE  03  RR         0       0  G
DTE  01  DISC/RQD           0  G
DCE  01  UA/NSA             0  G
DTE  01  SABM               0  G
_
```

Figure 32-10 The 2 key changes the display mode to frame trace.

During a BERT test, the operator can press T for a reading of the BERT counters, C to clear those counters, and E to inject a bit error into the COMSTATE I's BERT transmissions. See Figure 32-7.

When the operator sets an alarm on any of the COMSTATE I's eight triggers, that trigger coming true will sound an alarm on the remote terminal. An ALARM message will appear on the remote CRT, alongside any prompt that was entered on the same trigger menu as the alarm. See Figure 32-8.

Finally, if the remote terminal has detached from the unattended unit, the COMSTATE I will react to an alarm trigger by dialing a call to the remote terminal. This call-back feature is discussed in Section 32.6.

32.5 READING THE DATA BUFFER

When he has received a real-time alarm or when sufficient data has been captured in the unattended unit's data buffer, the operator at a remote terminal exits Run mode and accesses the data buffer by pressing ESC, P, F (PROGRAM, F). The current page of the 64-page data buffer is displayed on the terminal screen. (When you first leave Run mode and enter the data buffer, the last screen in the buffer is always the current screen.)

Data is displayed on the remote terminal without any enhancements. Each data character is allotted three spaces on the remote data display to accommodate control characters and hexadecimal. Since the COMSTATE I data screen is 32 columns wide, at the 3:1 character ratio a terminal display would need 96 columns to correlate line for line with the COMSTATE I display. Instead, the lines are divided in half, with the wraparound lines indented. See Figure 32-9.

When dual-line display has been selected on the Protocol Setup menu, all data is displayed in dual-line format. Refer again to Figure 32-9. A line of TD (or T) data is followed by a line of RD (or R) data and then by a line feed. The data line following a blank line is always TD (T) data. Dots replace the castle-shaped fill symbols (three dots for each character time).

We recommend the dual-line display for remote operation. Since terminals do not do underlining, the single-line display does not distinguish RD from TD.

The COMSTATE I converts all data to ASCII before it goes to the Printer/Remote interface. All characters for which there is no ASCII equivalent are transmitted at this port as two-digit hexadecimals.

Just as on the keyboard of the COMSTATE I, the B key calls up a display of the first screen in the data buffer. E brings up the last screen. If the data is HDLC or SDLC, the 2 key yields a frame-trace display of the current screen. See Figure 32-10. (Any subsequent buffer readings will be frame traces until the operator presses 1 or 3 instead.) The 3 key places the buffer in packet-trace mode. The 4 key is the combined frame-and-packet display, while the 1 key restores the data display.

To display the next buffer screen, press RETURN. CTRL K displays the previous screen.

```
DCE  004 DATA      1  2    G
DTE  004 RR       3       G
DCE  004 DATA      1  3    G
DTE  004 RR       4       G
DCE  004 DATA      1  4 Q  G
DTE  004 RR       5       G
DCE  004 DATA      1  5    G
DTE  004 DATA      5  1 Q  G
DCE  004 DATA      1  6    G
DTE  004 RR       6       G
DTE  004 RR       7       G
DCE  004 DATA      2  7    G
DTE  004 RR       0       G
DCE  004 DATA      2  0    G
DTE  004 RR       1       G
DCE  004 DATA      2  1    G
DTE  004 RR       2       G
DCE  004 DATA      2  2    G
DTE  004 RR       3       G
DCE  004 DATA      2  3    G
DTE  004 RR       4       G
DCE  004 DATA      2  4    G
DTE  004 RR       5       G
```

Figure 32-11 CTRL A scrolls the buffer from beginning to end.

```
        **MODEM PARAMETERS**

FUNCTION: CALL HANGUP ANSWER
CALL:
  STRING:_____________________________

CONNECT:
  STRING:_____________________________
    DELAY: __ SECONDS
  TIMEOUT: __ SECONDS

HANGUP:
  STRING:_____________________________
ANSWER:
  STRING:_____________________________
DON'T CARE key = 2 second delay
STATUS: Depress XEQ to Start
```

Figure 32-12 Program D Callback Menu Screen.

```
FLAGS:XXXXXXXX
TIMEOUT: NO
PROMPT:DTE DISConnect
TIMEOUT: NO
LOAD NO
    REV FRZ LOW
CRT: X   X   X
DLY STP: NO
FLAGS: SET
XXXXXXXX
TIMER: NO
COUNTER#1
: NO
ALARM: YES
OUTSYNC: NO

ALARM: YES
PREPARING TEST
ASCII/8/NONE/BOP

DETACHED

ALARM: DTE DISConnect _
```

Figure 32-13 The Callback communicates a prompt and an audible alarm.

```
**MODEM PARAMETERS**

FUNCTION: CALL
CALL:
STRING:
CONNECT:
STRING:
DELAY:
 SECONDS
TIMEOUT:
 SECONDS
HANGUP:
STRING:
ANSWER:
STRING:
DON'T CARE key = 2 second delay
STATUS: Depress XEQ to Start

CALL:
STRING:ATDT9,1,7036449044\CR_
```

Figure 32-14 The Program D menu as displayed at the remote terminal.

Unattended Remote Control includes a buffer-display function that is not available to an operator at a COMSTATE I keyboard. If the operator at a remote terminal presses CTRL A while the COMSTATE I is in Program F mode, the entire data buffer will scroll onto the terminal screen. This is a highly useful feature, especially in frame-trace or packet-trace mode, where the operator can scan the buffer for aborts, bad FCSs, out-of-sequence numbers, and special frames and packets. CTRL S (XOFF) stops the display, while any key will generate an XON that will allow the display to continue. Figure 32-11 shows one screen of this continuing display.

32.6 AUTOMATIC CALLBACK

Since it may be impractical for a remote operator to stay on line with a COMSTATE I for the duration of a long monitoring run or test, the unit has a callback feature that responds to a trigger-activated alarm by dialing the remote terminal and reporting the alarm condition.

On the COMSTATE I's side of the communication line there must be a modem (such as the Hayes Smartmodem 1200) intelligent enough to dial a number. On the terminal's side of the line, the modem must be able to answer a call.

32.6.1 Enabling the Callback Menu

Figure 32-12 shows the Program D MODEM PARAMETERS menu screen. As long as the COMSTATE I and the remote terminal are attached, this screen is disabled. When the COMSTATE I is detached from the remote terminal while it is in Run mode, the Program D screen is enabled and the unit attempts a callback whenever any trigger with YES selected in the ALARM field comes true.

In normal operation, the operator at the remote terminal sets the trigger alarm, enters Run mode (ESC, R) to start the test, and detaches (ESC, D). Figure 32-13 illustrates the entire sequence. Even though the remote terminal is detached, it still receives remote prompts and audible alarms as long as the test runs uninterrupted.

Apart from providing real-time feedback, the callbacks can be used to generate a Prompt trace (addressed to a remote printer, perhaps, instead of a terminal) of all triggers activated during a long interactive or monitor run.

32.6.2 Fields on the Callback Menu

All of the fields on the Program D menu have reference to the intelligent modem on the same side of the communications line as the unattended COMSTATE I.

The first field on the Program D menu is FUNCTION. This field permits manual calls by operators at attended units, and does not apply to automatic callback. See Section 31.2.2.

The next field on the Program D menu is CALL STRING. Enter the dial-up number of the remote modem (remote, that is, from the unattended COMSTATE I). To insert 2-second delays in this dial-up number, enter DON'T CARE characters (Backslash, D, C, on the remote keyboard). See Figure 32-14.

If the Internal Modem (Option 70) is installed and selected on Program A, CALL STRING and TYPE (tone or pulse) are the only auto-callback entries.

The CONNECT STRING is the signal that the modem sends to indicate that the remote modem has answered the call and is transmitting carrier. This string will vary with different intelligent modems. A blank field means that the COMSTATE I will send the alarm whether or not it has received a connect signal.

DELAY is the length of time after the connect string is received, before the COMSTATE I transmits the alarm. A blank field means no delay.

TIMEOUT is the time the COMSTATE I will wait for a connect string after sending the call string. If a connect string is received after timeout, the COMSTATE will not transmit the alarm. A blank field means no time limit.

The COMSTATE I transmits the HANGUP STRING immediately after it has sent the alarm. This string tells the modem to hang up the call, and will vary with different modems. If the correct string is not entered here, the COMSTATE I will remain on-line with the remote terminal (though not attached).

CAUTION: When you are entering the Hangup String remotely, be careful that you do not inadvertently hang up one or both modems. Usually a several-second pause between characters will prevent the modem from entering Command Mode and executing a hangup.

If a second alarm is activated while a callback is in progress, the new alarm and prompt are transmitted along with the alarm that initiated the callback.

ANSWER STRING does not apply to auto-callback.

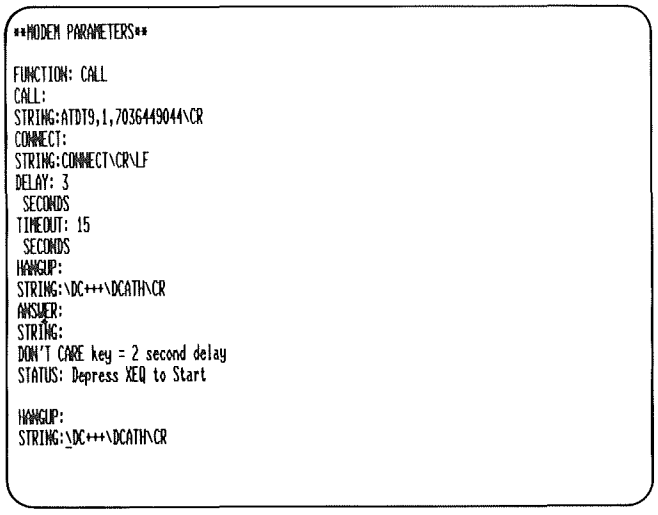


Figure 32-15 Sample entries on the Program D Auto-Callback menu.

TABLE 32-1
COMSTATE I: REMOTE-KEYBOARD CONTROL EXERCISED
BY COMSTATE I OR BY DUMB OR ANSI TERMINAL

Function or Keystroke Effected on Unattended COMSTATE I	Remote Operator Using Dumb/ANSI Terminal	Remote Operator Using COMSTATE I as Program A Terminal	Remote Operator Using ANSI Keypad
Attach/Detach			
(Attach)	BREAK	CTRL \ (@)	
(Detach)	ESC, D	CTRL +, D	
Modes			
PROGRAM	ESC, P	CTRL +, P	
RUN	ESC, R	CTRL +, R	
XEQ	ESC, X	CTRL +, X	
Program Mode: Screen Display			
(Repeat last message)	CTRL R	CTRL R	
(List whole screen)	CTRL A	CTRL A	
(Stop listing)	CTRL S (XOFF)	CTRL S (XOFF)	
(Continue listing)	CTRL Q (XON) or any key	CTRL Q (XOFF) or any key	
CLEAR field	CTRL C or ESC, [, K	CTRL C or CTRL +, CTRL 8, K	
CTRL CLEAR	CTRL Z or ESC, [, J	CTRL Z or CTRL +, CTRL 8, J	
Program Mode: Cursor Control			
ROLL left	CTRL H or ESC, [, D	CTRL H or LEFT ARROW or CTRL +, CTRL 8, D	SHIFT 4
ROLL right	CTRL L or ESC, [, C	CTRL L or RIGHT ARROW or CTRL +, CTRL 8, C	SHIFT 6

(continued)

Table 32-1 (continued)

Function or Keystroke Effected on Unattended COMSTATE I	Remote Operator Using Dumb/ANSI Terminal	Remote Operator Using COMSTATE I as Program A Terminal	Remote Operator Using ANSI Keypad
ENTER (next field)	CTRL J or CTRL M or RETURN or ENTER or ESC, [, B	CTRL J or RETURN or ENTER or DOWN ARROW or CTRL +, CTRL 8, B	SHIFT 2
(Previous field)	CTRL K or ESC, [, A	CTRL K or UP ARROW or CTRL +, CTRL 8, A	SHIFT 8
SHIFT LEFT ARROW (to delete character)	DELETE or ESC, [, P	DEL (CTRL _) or CTRL +, CTRL 8, P	SHIFT 9
SHIFT RIGHT ARROW (to insert character)	ESC, [, 4, h	CTRL +, CTRL 8, 4, h	SHIFT 7
SHIFT DOWN ARROW (to insert line on Program 7 screen)	ESC, [, L	CTRL +, CTRL 8, L	SHIFT 1
SHIFT UP ARROW (to delete line on Program 7 screen)	ESC, [, M	CTRL +, CTRL 8, M	SHIFT 3
CTRL ENTER (to reach page 2 of Screen 7)	ESC, RETURN	CTRL +, RETURN	
Program Mode: Special Data-Entry Characters			
HEX	#XY	#XY	
#	##	##	

(continued)

Table 32-1 (continued)

Function or Keystroke Effected on Unattended COMSTATE I	Remote Operator Using Dumb/ANSI Terminal	Remote Operator Using COMSTATE I as Program A Terminal	Remote Operator Using ANSI Keypad
Control characters	\, 1st mnemonic character, last mnemonic character. Examples: \Dl, \EQ, \SX, \EX, \EB, \ET Exceptions: \SY (for SYN), \PD (for DEL), \NU (for NULL)	\, 1st mnemonic character, last mnemonic character. Examples: \Dl, \EQ, \SX, \EX, \EB, \ET Exceptions: \SY (for SYN), \PD (for DEL), \NU (for NULL)	
\	\\	\\	
FLAG/FOX	\7E or \FM	\7E or \FM	
NOT EQUAL	\NE Example: \NE\7E	\NE Example: \NE\7E	
DON'T CARE	\DC	\DC	
BIT MASK/MSG	\BM (followed by RETURN for Bit Mask string)	\BM (followed by RETURN for Bit Mask string)	
Run Mode			
FREEZE (remote CRT, triggers, and test activity; also display CRT buffer for current screen).	F	F	
Unfreeze	F	F	

(continued)

Table 32-1 (continued)

Function or Keystroke Effected on Unattended COMSTATE I	Remote Operator Using Dumb/ANSI Terminal	Remote Operator Using COMSTATE I as Program A Terminal	Remote Operator Using ANSI Keypad
("Tally": List Program 2 or BERT statistics without interrupting test)	T	T	
DON'T CARE (to inject bit error into BERT test)	E	E	
CLEAR (to clear BERT counters)	C	C	
Program F: Data Buffer			
B (to display first screen in buffer)	B	B	
E (to display last screen in buffer)	E	E	
SHIFT or CTRL DOWN ARROW (to display next screen)	CTRL J or CTRL M or RETURN or ENTER or ESC, [, B	CTRL J or RETURN or ENTER or DOWN ARROW or CTRL +, CTRL 8, B	SHIFT 2
SHIFT or CTRL UP ARROW (to display previous screen)	CTRL K or ESC, [, A	CTRL K or UP ARROW or CTRL +, CTRL 8, A	SHIFT 8
(Display data buffer from beginning to end)	CTRL A	CTRL A	
1 (to display current screen in data format)	1	1	1

(continued)

Table 32-1 (continued)

Function or Keystroke Effected on Unattended COMSTATE I	Remote Operator Using Dumb/ANSI Terminal	Remote Operator Using COMSTATE I as Program A Terminal	Remote Operator Using ANSI Keypad
2 (to display current screen in HDLC/SDLC frame-trace display)	2	2	2
3 (to display current screen in X.25 packet-trace display)	3	3	3
4 (to display current screen in X.25 combined frame packet trace display)	4	4	4
HEX	H	H	
CTRL HEX	C	C	
(Stop display)	CTRL S (XOFF)	CTRL S (XOFF)	
(Continue display)	CTRL Q (XON) or any key	CTRL Q (XON) or any key	
(Scroll up remote buffer; no effect on unattended COMSTATE I)		SHIFT UP ARROW	
(Scroll down remote buffer; no effect on unattended COMSTATE I)		SHIFT DOWN ARROW	

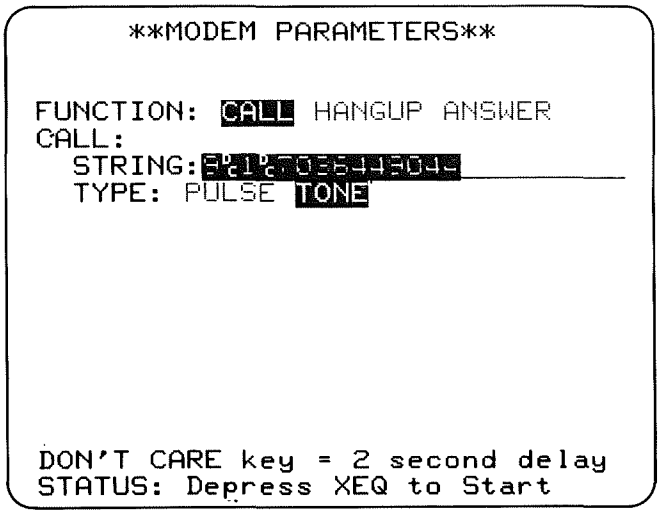


Figure 33-1

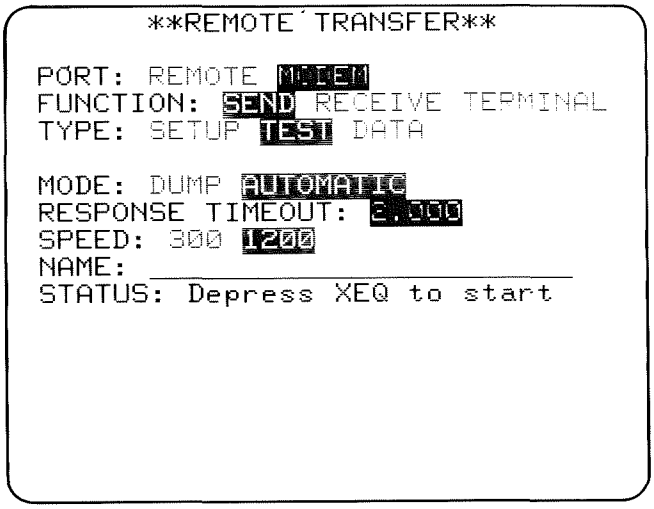


Figure 33-2

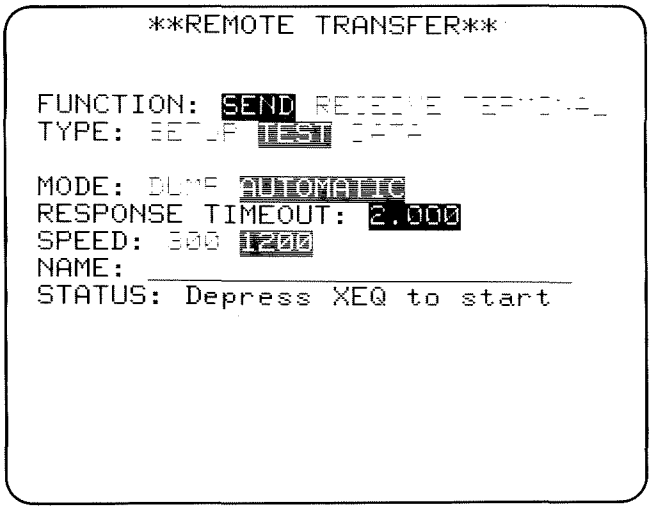


Figure 33-3

33
INTERNAL MODEM (OPTION 70)

The Internal Modem card (OPT-932-70-1) and its special telephone-jack interface perform the modem functions and remote-transfer functions normally executed by an external modem in conjunction with the PRINTER/REMOTE interface at the rear of the COMSTATE I. Modem functions include dialing, answering, and hanging up calls. Remote-interface functions include uploading and downloading tests and data, controlling an unattended remote COMSTATE I or INTERVIEW 30B/40B, and being controlled by a remote terminal (or INTERVIEW device in Terminal mode).

The modem card is installed in Slot 4 of the Memory Adaptor-Programmer printed-circuit board (OPT-932-20-2). If the modem card is installed in your unit and if the unit's software version is 12.04 or higher, the numbers 20-2 and 70-1 will appear in the OPTIONS field on your COMSTATE I screen at power-up.

33.1 MODEM INTERFACE AND DATA SPEED

To connect the COMSTATE I directly to the telephone line, insert the phone-line plug into the RJ-11C jack at the rear of the COMSTATE (near the cover, right of the fan). A double-jack adaptor was included in the shipment of your modem option. You may use this adaptor to connect both a phone line and a separate handset to the internal modem.

The modem card contains a Bell 212-compatible modem component with data speeds of 300 and 1200. The operator directs the activities of this modem by making entries on the Modem Parameters menu screen, Program D. See Figure 33-1. If the operator initiates a call on this menu, the data speed of the transmission will be the rate selected on the Remote Transfer menu, Program A. See Figure 33-2. (There are two speeds selectable, 300 and 1200 bps, when MODEM is selected in the PORT field at the top of the Program A screen.) If the internal modem answers a call, it allows itself to be trained to the speed (300/1200) of the remote modem. The speed selection on the Program A menu adjusts automatically to the new modem speed.

33.2 MODEM FUNCTIONS: CALL

With the COMSTATE I connected to a phone line and MODEM selected on the top line of the Program A menu, place a call as follows:

- Select FUNCTION: CALL on the Program D menu;
- Enter a call string (using DON'T CAREs as 2-second delays in the dialing sequence);

- Select either TONE or rotary-type PULSE dialing;

- Press XEQ.

A status message at the bottom of the Program D screen will alert you when the call is connected.

The Program D screen is the "call connection" menu screen. Once you have established a connection, exit this menu and move to Program A, Remote Transfer. Use the Remote Transfer menu to emulate a terminal or to transfer tests and data to and from a remote INTERVIEW. See Sections 31 and 32.

With a call established, the PORT field on the Program A menu has disappeared (Figure 33-3). When one of the remote-transfer ports (REMOTE or MODEM) is in use, the other is not available for selection.

To gain control of an unattended remote COMSTATE I or 30B/40B, first select TERMINAL and press XEQ. Then press BREAK and follow the rest of the attaching sequence outlined in Section 32.1.

See Section 32 for a description of all aspects of remote-control operation.

33.3 MODEM FUNCTIONS: HANGUP

If the remote INTERVIEW has an internal modem, you can hang up a call to that unit without exiting your own Remote Transfer (Program A) screen. In Terminal mode, press ESC, D (CTRL *, D, on the COMSTATE I keyboard). The receiving unit will hang up automatically after receiving this DETACH command. Remain in Terminal mode if you are anticipating an auto-callback (see Section 32.6).

If the remote modem is external, the DETACH command will relinquish control of the remote unit but it will not cause the remote modem to disconnect. Always detach first; but afterwards go to Program D in your unit and select HANGUP. Press XEQ.

If you are expecting an auto-callback, return now to Program A Terminal mode.

33.4 MODEM FUNCTIONS: ANSWER

The internal modem answers a call automatically when it receives two rings. It trains on the speed of the calling modem and sets the COMSTATE I's remote speed to 300 or 1200 bps.

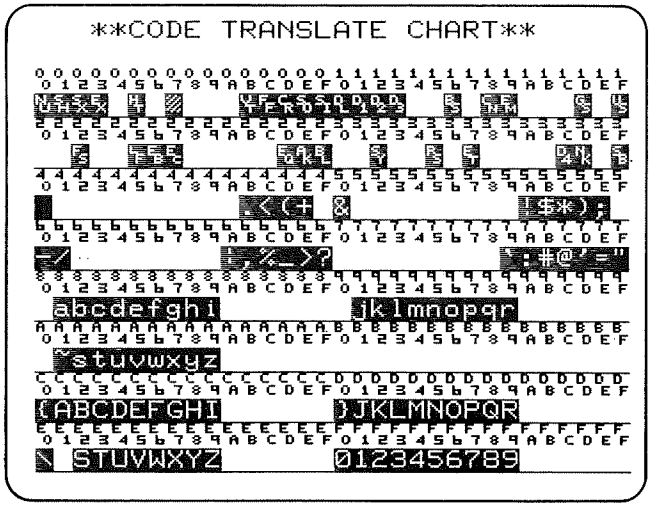
There is a manual ANSWER also. Use this Program D selection when you want to convert a voice connection to data. For example, you might have a telephone line and a handset plugged into the one-to-two modular adaptor at the rear of your unit. You begin by using the handset to place a call and to talk. When you want to transmit and receive data, execute an ANSWER.

At the ANSWER command, your modem will pause two seconds, then send an answer tone (2225 Hz) on the telephone line. To complete the data-connect handshake, the remote modem must respond to the answer tone by transmitting carrier. An Originate command at that modem will supply the correct sequence. If the remote modem is external to its INTERVIEW, consult the user manual for the Originate command.

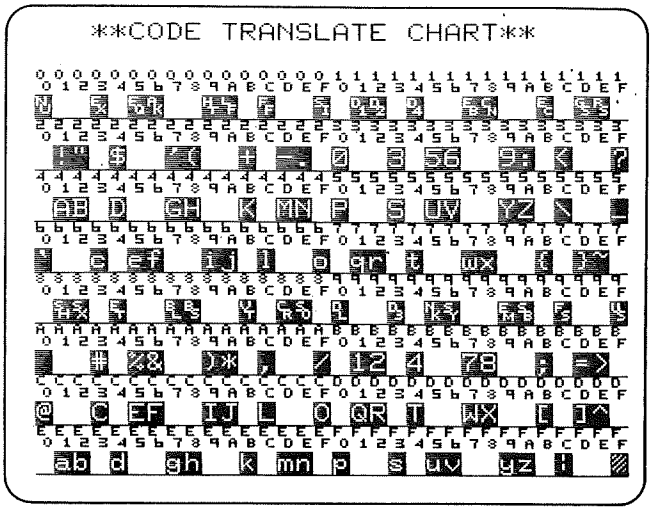
In the INTERVIEW Internal Modem, the Originate command is a Program D CALL command with a blank CALL STRING.

PART VII
APPENDIXES

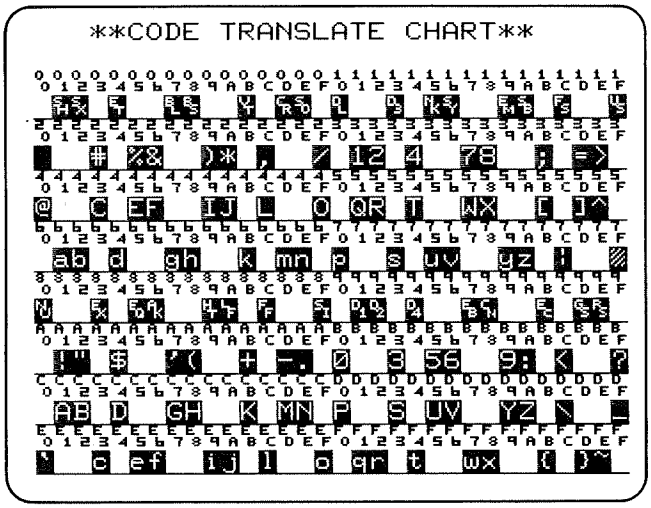
APPENDIX A
CODE TRANSLATE CHARTS



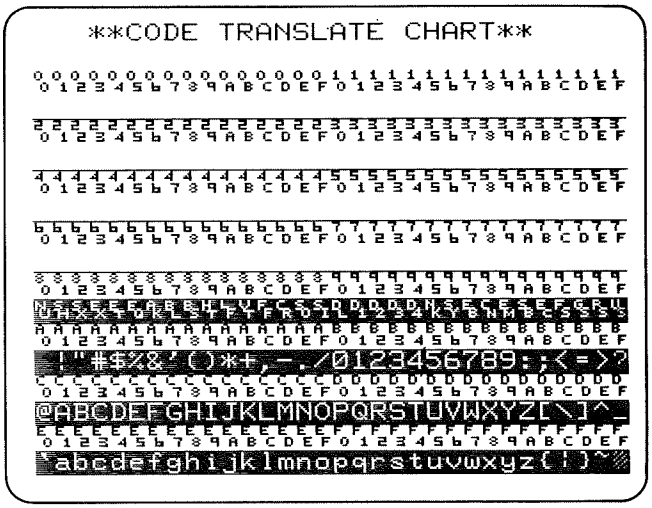
EBCDIC, 8 BITS, NONE



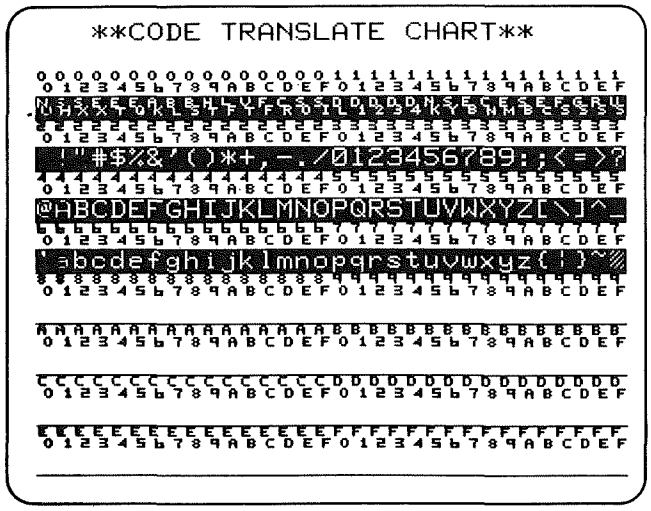
ASCII, 7 BITS, EVEN



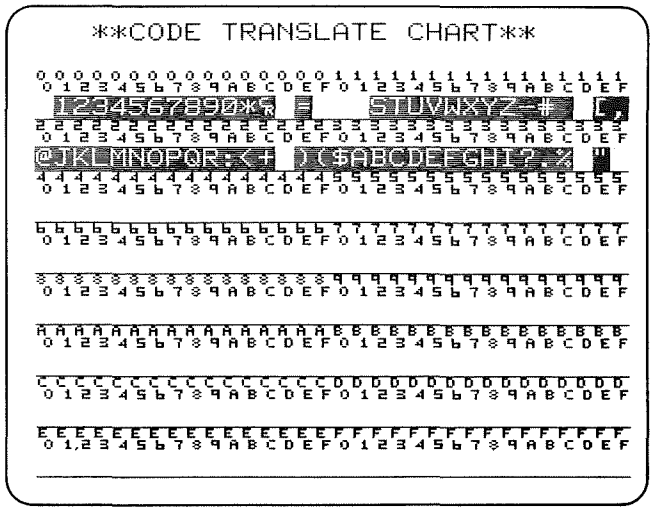
ASCII, 7 BITS, ODD



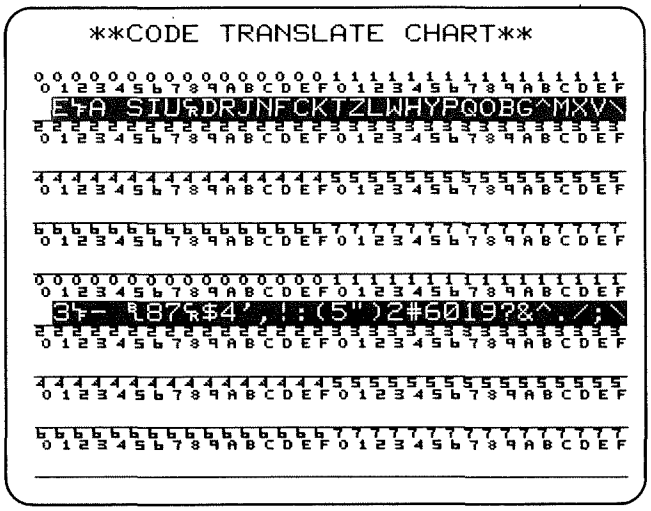
ASCII, 7 BITS, MARK



ASCII, 7 BITS, SPACE



IPARS, 6 BITS, NONE, INV/REV



BAUDOT, 5 BITS, NONE

APPENDIX B
CONTROL CHARACTER MNEMONICS

AK	ACK: Acknowledgment
BL	BEL: Bell
BS	Backspace
CN	CAN: Cancel
CR	Carriage return
D1	DC1: Device control 1
D2	DC2: Device control 2
D3	DC3: Device control 3
D4	DC4: Device control 4
DL	DLE: Data link escape
EB	ETB, EOB: End of transmission block
EC	EOC: End of card
EM	EOM: End of message
EQ	ENQ: Enquiry
ET	EOT: End of transmission
EX	ETX: End of text
FF	Form feed
FS	Field separator
GS	Group separator (or Interchange group separator)
HT	Horizontal tabulate
LF	Line feed
NK	NAK: Negative acknowledgment
NU	Null
Pad	DEL or idle line
RS	Record separator
SB	SUB: Substitute
SH	SOH: Start of header
SI	Shift in
SO	Shift out
SX	STX: Start of text
SY	SYN: Synchronization character
US	Unit separator
VT	Vertical tabulate

APPENDIX C
ACRONYMS AND ABBREVIATIONS

ABT	ABorT
ADR	ADdRess
ASCII	American Standard Code for Information Interchange
ASYN	ASYNchronous format (indicates START and STOP bits)
AUTO SYNC	Automatically recognizes synchronization pattern as 16-bit pattern
AUX	Auxiliary
B	Bad BCC
BCC	Block Check Calculation
BDBCC	BaD BCC
BDLC	Burroughs Data Link Control
BERT	Bit Error Rate Test
BISYNC	Binary Synchronous Communications Protocol (IBM); also BSC
BLI	BLInk (CRT enhancement)
B/NRZI	Bit-Oriented Protocol, NonReturn to Zero Inverted
BOP	Bit-Oriented Protocols, e.g., HDLC, bit stuffing

bps	bits per second
BSC	See BISYNC
CCITT	Consultive Committee, International Telephone and Telegraph
CHAR	CHARacters
CNTRL CHARS	CoNTRoL CHARacterS
CR/LF	Carriage Return/Line Feed
CRC	Cyclical Redundancy Check
CRT	Cathode Ray Tube
CS	Current State
CTS	Clear To Send character
D	D bit (Bit 7 in Octet 3 of packet-level X.25)
DA-15	15-Pin D connector (standard for X.21)
DB-25	25-Pin D connector (standard for RS-232/V.24)
DC	Don't Care character (keyboard key); also Device Control
DCE	Data Circuit-Terminating Equipment (or Data Communications Equipment)
DEC	DECrement
DEL	DELete
DLE	Data Link Escape character (used principally in transparent BISYNC)
DLY STP	DeLaYed SToP
DSR	Data Set Ready (RS-232/V.24 control lead)
DTE	Data Terminal Equipment
DTR	Data Transmit Ready (RS-232/V.24 control lead)
DUP	DUPlicate

EBCDIC	Expanding Binary Coded Decimal Interchange Code
EIA	Electronic Industries Association
ENTR	ENTeR key
ENQ	ENQuiry character
EROM	Electrically-erasable Read Only Memory
EXT	EXTernal (speed)
FDX	Full Duplex (permits simultaneous data in both directions)
FCS	Frame Check Sequence (used in BOP)
Flag	HDLC 7E(hex) framing; the 4600's FLAG key
FRZ	FReeZe
G	Good BCC
GDBCC	GooD BCC
HDLC	High Level Data Link Control procedure
HDX	Half Duplex (data cannot be transmitted in both directions simultaneously)
HEX	Hexadecimal number; also the 4600's HEXadecimal key
Hz	Hertz
ID	IDentification
IDLE SYN	IDLE SYNchronization characters
INC	INCrement
INFO	INFOrmation (usually refers to a type of frame)
INT	INTernal (speed)
INV	INVerted data
INV/REV	INVerted and REVersed data

ISOC	ISOChronous format
ITB	Intermediate Transparent Block character
kbps	Kilobits per second
LED	Light-Emitting Diode
LCN	Logical Channel Number (X.25 packet-level term)
LN	Line Number
LO	LOw intensity (CRT enhancement)
LRC	Longitudinal Redundancy Check
M	M bit (X.25 packet-level, Bit 4 of Octet 3)
MAINTN	MAINTaiN lead status
mSEC	MilliSEConds
MOD	MODulus (number of outstanding frames or packets, usually 8)
MON	MONitor mode
MRK	MaRK
MSG	Message
N	No BCC
NR	Number Received (frames)
NRAM	Non-volatile Random Access Memory (does not erase when power is shut off)
NRZI	Non-Return to Zero Inverted (used with SDLC and ASYNC modems--sometimes with clocked modems)
NS	Next State (on Interactive Test Menu)
NS	Number Sent (frames, in X.25 frame display mode)
1OF	One OF
OUTSYNC	OUT of SYNChronization

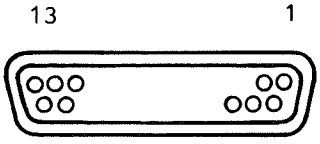
P	Prompt
PAK	PAcK
PAR	PARity
PARAM	PARAMeter
P/F	Poll/Final bit used in control byte at frame level (X.25/SDLC)
PR	Packet Received
PS	Packet Sent
Q	Q bit (Bit 8 of Octet 1 in packet-level X.25)
QDM	Qualifyer bit Delivery Confirmation bit More data bit
R	Record (on extended memory card)
RAM	Random Access Memory; the INTERVIEW 4600's high-speed memory option
RD	Received Data
REC BCC	Received BCC
REV	REVerse video (black character on white background on CRT)
RLSD	Received Line Signal Detect (RS-232/V.24 signal)
RESYNC	RESYNChronize
ROM	Read Only Memory (firmware/software storage)
RS-232	List of definitions for interchange circuit between data terminal equipment and data circuit termination equipment established by EIA
RSTRT	ReSTaRT timer
RTS	Ready To Send

S	Slot (of extended memory card)
SCRN	SCReeN
SDC	Selective Direct Call
SDLC	Synchronous Data Link Control (IBM); analogous to frame level
SLCTDIRCALL	SeLeCTive DIRect CALL
SNA	System Network Architecture (IBM)
SOH	Start of Header character
SPC	SPaCe
STG	STrinG
STX	Start of Text character
SY, SYNC CHARS	Abbreviations for synchronization character in the code set (SY used in CRT font)
SYN	SYNChronous format (as distinct from ASYNC or X.25 or SDLC)
TD	Transmitted Data
TERM	TERMinal
TP	Test Point
TRIG	TRIGger
TX	Transmit Message
UA	User Assigned input
UROM	Ultraviolet-erasable Read Only Memory
VRAM	Volatile Random Access Memory (erased each time power is turned off)
VRC	Vertical Redundancy Check
V.24	List of definitions for interchange circuit between data terminal equipment and data circuit termination equipment established by the CCITT

V.24/MIL	Military version of V.24 specification (equivalent to Military Specification 188)
X.21	CCITT recommendation on the interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for synchronous operation on public data networks
X.25	See HDLC
XEQ	EXEQute
XFER	Transfer
XMIT	Transmit; transmission

APPENDIX D
COMSTATE I INTERFACE SPECIFICATIONS

TABLE D-1
COMSTATE I V.24/RS-232 FRONT PANEL CONNECTOR



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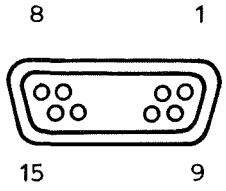
Pin No.	Pin Name	Signal Description		
		Monitor	Test DCE	Test DTE
1	Frame Ground	Ground	Ground	Ground
2	TD	High Impedance Input	RS-232/V.24 Output	RS-232/V.24 Input
3	RD	High Impedance Input	RS-232/V.24 Input	RS-232/V.24 Output
4	RTS	High Impedance Input	RS-232/V.24 Output	RS-232/V.24 Input
5	CTS	High Impedance Input	RS-232/V.24 Input	RS-232/V.24 Output
6	DSR	High Impedance Input	RS-232/V.24 Input	RS-232/V.24 Output
7	Signal Ground	Ground	Ground	Ground
8	RLSD	High Impedance Input	RS-232/V.24 Input	RS-232/V.24 Output
9	--	Test Point	Test Point	Test Point
10	--	Test Point	Test Point	Test Point
11	--	Test Point	Test Point	Test Point
12	SRLSD	Test Point	Test Point	Test Point
13	SCTS	Test Point	Test Point	Test Point
14	STD	Test Point	Test Point	Test Point
15	SCT	High Impedance Input	RS-232/V.24 Input	RS-232/V.24 Output
16	SRD	Test Point	Test Point	Test Point
17	SCR	High Impedance Input	RS-232/V.24 Input	RS-232/V.24 Output
18	--	Test Point	Test Point	Test Point
19	SRTS	Test Point	Test Point	Test Point
20	DTR	High Impedance Input	RS-232/V.24 Output	RS-232/V.24 Input
21	SQ	Test Point	Test Point	Test Point
22	RI	Test Point	Test Point	Test Point
23	DSRS	Test Point	Test Point	Test Point
24	SCTE	High Impedance Input	RS-232/V.24 Output	RS-232/V.24 Input
25	--	Test Point	Test Point	Test Point

TABLE D-2
COMSTATE I X.21 ADAPTOR (FEMALE CONNECTOR)



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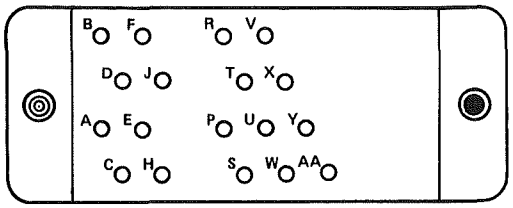
		Signal Description		
Pin No.	Pin Name	Monitor	Test DCE	Test DTE
1	Shield	Shield	Shield	Shield
2,9	T Transmit Data	High Impedance Input	V.10 Output	V.10 Input
3,10	C Control Data	High Impedance Input	V.10 Output	V.10 Input
4,11	R Receive Data	High Impedance Input	V.10 Input	V.10 Output
5,12	I Indicator	High Impedance Input	V.10 Input	V.10 Output
6,13	S Signal Timing	High Impedance Input	V.10 Input	V.10 Output
7,14	B Byte Strobe	High Impedance Input	V.10 Input	V.10 Output
8	Ground	Ground	Ground	Ground
15	---	Test Point	Test Point	Test Point

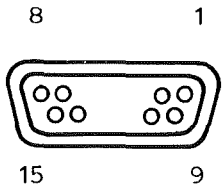
TABLE D-3
COMSTATE I V.35 ADAPTOR (FEMALE CONNECTOR)



TW-932-083

		Signal Description		
Pin No.	Pin Name	Monitor	Test DCE	Test DTE
A	Protective Ground	Ground	Ground	Ground
B	Signal Ground	Ground	Ground	Ground
C	RTS	High Impedance Input	V.35 Output	V.35 Input
D	CTS	High Impedance Input	V.35 Input	V.35 Output
E	DSR	High Impedance Input	V.35 Input	V.35 Output
F	RLSD	High Impedance Input	V.35 Input	V.35 Output
H	DTR	High Impedance Input	V.35 Output	V.35 Input
J	RI	Test Point	Test Point	Test Point
P,S	TD	High Impedance Input	V.35 Output	V.35 Input
R,T	RD	High Impedance Input	V.35 Input	V.35 Output
U,W	SCTE	High Impedance Input	V.35 Output	V.35 Input
V,X	SCR	High Impedance Input	V.35 Input	V.35 Output
Y,AA	SCT	High Impedance Input	V.35 Input	V.35 Output

TABLE D-4
COMSTATE I "AUXILIARY" CONNECTOR



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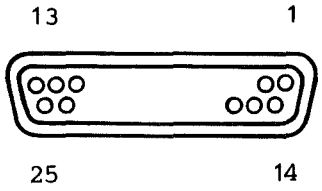
Pin No.	Pin Name	Signal Description
1		
2		
3	Ground	Ground
4	Ground	Ground
5	Ground	Ground
6		
7	AUX OUT	LSTTL Output (Follows Flag 8)
8	AUX IN	LSTTL Input (Not Used)
9		
10		
11		
12		
13		
14		
15		

TABLE D-5
COMSTATE I "PRINTER/REMOTE" CONNECTOR



TW-932-018

Pin No.	Pin Name	Signal Description
1	Ground	Ground
2	TD	RS-232/V.24 Input
3	RD	RS-232/V.24 Output
4		
5	CTS	RS-232/V.24 Output
6	DSR	RS-232/V.24 Output
7	Signal Ground	Ground
8	RLSD	+12 V (through 1K ohm resistor)
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20	DTR	RS-232/V.24 Input
21		
22		
23		
24		
25		

APPENDIX E
MESSAGES TO THE OPERATOR

Message	Comments
CANNOT INTERNALLY ERASE	COMSTATE I cannot erase UROM card. (See Section 29.4.6.)
CMP ERR(1)	Attempt to compile program has been unsuccesful, probably due to a software error. Contact Atlantic Research.
CMP ERR(2)	Attempt to compile program has been unsuccesful, probably due to a software error. Contact Atlantic Research.
CHECKSUM ERROR ON READ	Record cannot be read correctly. Contact Atlantic Research for recovery procedure.
DATA BUFFER EMPTY	The COMSTATE I does not have any data in the buffer, so it will not perform the save or transfer you requested.
DATA VERS. NOT SUPPORTED	The Data at the Printer/Remote interface or in the memory cannot be displayed by this unit.

(continued)

Message	Comments
DUPLICATE TO SAME CARD	You have attempted to duplicate with same slot number entered in both fields on Line 6 of the Library Utilities menu.
"FROM" CARD IS BLANK	The COMSTATE I will not attempt to duplicate an empty card.
HEADER CHECKSUM ERROR	Name cannot be read correctly.
INVALID CARD FORMAT	You have attempted to gain access to a card that has an invalid linked-list structure.
INVALID CS ENTERED	Invalid entry in the Current State field. The asterisk (*) can only be used in the Next State field.
INVALID "FROM" LINE	An invalid "FROM" data buffer line number has been entered in the first field of line 5 on either the Remote Transfer menu or the Library Utilities menu. The number is either greater than the last line currently in the buffer, or greater than 1024 (last possible line in the data buffer).
INVALID SLOT NUMBER	The only valid Slot numbers are 0, 1, 2, and 3.
INVALID "TO" LINE	An invalid "TO" data buffer line number has been entered in the second field of Line 5 of the Remote Transfer menu or the Library Utilities menu. The "TO" line number must be greater than the "FROM" line number.
INVALID WF FOR LSD MODE	Invalid WAIT FOR entry on the Interactive Test menu when unit is in X.21 Leased mode on X.21 Protocol Control menu.

(continued)

Message	Comments
MULTIPLE DEFINITION OF CS	You have used a Current State in two separate places in the Interactive Test menu. All enties for a single state must be contiguous.
NO CARD IN "FROM" SLOT	No memory card in the "FROM" slot specified on Line 6 of the Library Utilities menu, or DIP switch S1 on card incorrectly set (see Section 29.7).
NO CARD IN SLOT	No memory card in the slot entered on Line 6 of the Library Utilities menu, or DIP switch S1 on card incorrectly set (see Section 29.7).
NO CARD IN "TO" SLOT	No memory card in the "TO" slot specified on Line 6 of the Library Utilities menu, or DIP switch S1 on the card incorrectly set (see Section 29.7).
NO DEFAULT CONTROL CHARACTERS	The Code you have selected has no default control characters, and therefore no default Block Check Characters.
NO RECEIVER RESPONSE	During an AUTOMATIC transfer, the source COMSTATE I has stopped receiving acknowledgments from the destination COMSTATE I and has aborted the transmission; or CTS has not been received within 1 second after RTS driven ON.
NO RECORDS AVAILABLE	You have attempted to write a record to a card on which all records (0 through 99) are currently assigned.
NO ROOM ON CARD	You have attempted to write a record to a card that does not have enough room for it.

(continued)

Message	Comments
NO ROOM ON CARD, PACK	You have attempted to write a record to a card that does not have enough room for it. PAcKing the card would free sufficient room for this record.
OVRFLW(10)	System error; contact Atlantic Research Corporation
OVRFLW(11)	System error; contact Atlantic Research Corporation
OVRFLW(12)	System error; contact Atlantic Research Corporation
PREMATURE END OF DATA	Record received is shorter than specified by its header.
RECORD CHECKSUM ERROR	A record has been received, but it contained errors and could not be used.
RECORD NOT FOUND	Cannot find the designated record on the card specified.
RECRD TYPE NOT SUPPORTED	The format of the record found in memory or being received at the Printer/Remote interface cannot be used in this unit.
SCREEN NOT APPLICABLE FOR BOP	Bit-Oriented Protocols have well-defined Block Checking procedures; the BCC Parameters menu will not alter BOP Block Checking procedures.
SETUP VERS NOT SUPPORTED	The Setup found in memory or being received at the Printer/Remote interface cannot be used in this unit.
TERMINAL -- INVALID FORMAT	In Terminal mode the COMSTATE I must be in ASYNC or ISOC Format.

(continued)

Message	Comments
TEST VERS. NOT SUPPORTED	The Test found in memory or being received at the Printer/Remote interface cannot be used in this unit.
"TO" CARD IS NOT BLANK	Will not duplicate to a recorded card. Erase "TO" card first.
"TO" CARD IS TOO SMALL	Have attempted to duplicate a memory card to a card with a smaller memory.
TOO MUCH DATA RECEIVED	The record received is longer than specified by its header.
TRANSMISSION ABORTED	Transfer has been aborted by the source unit.
UNCORRECTABLE FORMAT ERR	A write error has destroyed the linked-list structure of the card. The only way to correct it is to erase the card.
UNDEFINED NS	Undefined Next State. One of the Next State entries on the Interactive Test menu does not have a corresponding Current State entry, or there is an illogical Next State.
UNPACKABLE MEMORY TYPE	UROM cards and internal memory cannot be packed.
UNRECOGNIZED CARD TYPE	DIP switch S1 on memory card incorrectly set (see Section 29.7).

(continued)

Message	Comments
V24 MODE -- X21 WAITFOR SELECTED	An X.21 WAIT FOR selection has been made on the Interactive Test menu, but the COMSTATE I is operating in V.24/RS-232 mode. Correct either the Interactive Test menu or the X.21 Protocol Control menu.
WRITE ERR, CARD PROT'D	A write error has occurred. It could not be corrected but did not affect any records previously written. The card has been marked to prevent attempts to write to it, but blocks already recorded on the card can be LOADed.
WRITE ERROR	Attempt to write has been unsuccessful, probably because of a hardware failure.
WRITE TO INTERNAL MEMORY	Cannot write to internal memory, slot 0.
WRITE TO INVALID CARD	You have attempted to write to a card that has an invalid linked-list structure.
WRITE TO PROTECTED CARD	You have attempted to write to a write-protected card (DIP switch S1-8 is ON).
WRITE TO READ ONLY MEM	Attempt to write has been unsuccessful, probably due to a software error.

APPENDIX F
COMMUNICATIONS WITH THE ARC TELEPRODUCTS FACTORY

F.1 RETURNING A COMSTATE I OR SUBASSEMBLY FOR REPAIR

F.1.1 Authorization

(1) The first step is always to call the ARC Teleproducts REPAIR CLERK in Springfield, Virginia: 703-644-9020.

(2) The Repair Clerk will give you a RETURN AUTHORIZATION NUMBER. This number should be posted on the outside of the package of all equipment returned for repair, and cited in all documentation, written correspondence, or telephone conversations concerning the specific repair.

(3) Turnaround time for repairs is usually two weeks in addition to transportation time. The Repair Clerk can arrange to furnish a rental unit if it is not practical for you to be without the COMSTATE I for that length of time. We can either include the rental fee on the repair bill or bill the rental fee separately.

F.1.2 Shipping

(1) Always include with the shipment a detailed description of the problem to be corrected. Put the assigned RETURN AUTHORIZATION NUMBER on this document.

(2) If the item is out of warranty, you should either --

(a) authorize the amount of the repair in dollars;

(b) request an estimate of the amount of the repair.

(3) Select suitable packing materials for electronic equipment containing a cathode ray tube, and pack the COMSTATE I with care. If possible, the carton and "clamshell" packing material in which you received the equipment should be used for returning it for repairs.

(4) Write the RETURN AUTHORIZATION NUMBER on the outside of the shipment.

(5) Address the shipment to

REPAIR DEPARTMENT
Atlantic Research Corporation
Teleproducts Division
7401 Boston Boulevard
Springfield, Virginia 22153
U.S.A.

(6) Ship PREPAID. No collect shipments will be accepted unless previously authorized by the Repair Clerk.

(7) Most repairs will be completed within two weeks, not including transportation time.

F.2 ORDERING REPLACEMENT PARTS OR ASSEMBLIES

To obtain price quotations or to order spare or replacement parts, contact the REPAIR CLERK by telephone, 703-644-9020.

The Repair Clerk will need to know the model designation of the unit, its serial number and software version, and what options are already installed in it.

F.3 PC BOARD OR SUBASSEMBLY EXCHANGES

Contact the REPAIR CLERK to arrange to exchange PC Boards or Subassemblies that need repairs. The Repair Clerk can arrange to send you the replacement part immediately. You will then be responsible for the list price value of the part until ARC has actually received the returned part.

F.4 FOR ANALYSIS OF PROBLEMS

For assistance using ARC equipment in technical applications, call CUSTOMER SUPPORT, 703-644-9190.

For technical assistance with troubleshooting or repairing ARC equipment, call REPAIR DEPARTMENT at 703-644-9020.

F.5 WARRANTIES

There is a standard warranty on all ARC Teleproducts equipment. This warranty is for 12 months on equipment delivered inside the USA; and for 14 months if the equipment is delivered outside the USA.

Extended Service Agreements are available on some equipment. Please contact the Repair Clerk, at 703-644-9020, for more information.

APPENDIX G
PACKING AND SHIPPING

When the COMSTATE I is hand-carried, it will probably be subjected to much less severe treatment than when it is shipped by freight. Atlantic Research Corporation offers its COMSTATE I Option 919-99-1 Padded Travel Bag, stock No. 37409, for this purpose. This bag provides two inches of high-density foam protection for all surfaces of the COMSTATE I. It is yellow for easy identification among other luggage. An identification card case, FRAGILE markings, and leather appointments are standard features. Inside is a large pocket for carrying notes, manuals, and so forth. The bag provides reasonable protection for the COMSTATE I. Atlantic Research Corporation can assume no liability for damage to units transported in this bag, however, since circumstances will be beyond our control.

Inquire also about our new hardshell travel case, OPT-932-95-1.

For freight shipment, the COMSTATE I should be packed only in high-density Styrofoam "clamshell" and a heavy-duty outer cardboard carton, as delivered by Atlantic Research. This packing system has been designed to provide maximum reasonable protection to the COMSTATE I and insure its safe arrival. However, damages due to mishandling must be the responsibility of the Carrier.

NOTE: Please do not return any unit to Atlantic Research Corporation without prior authorization.

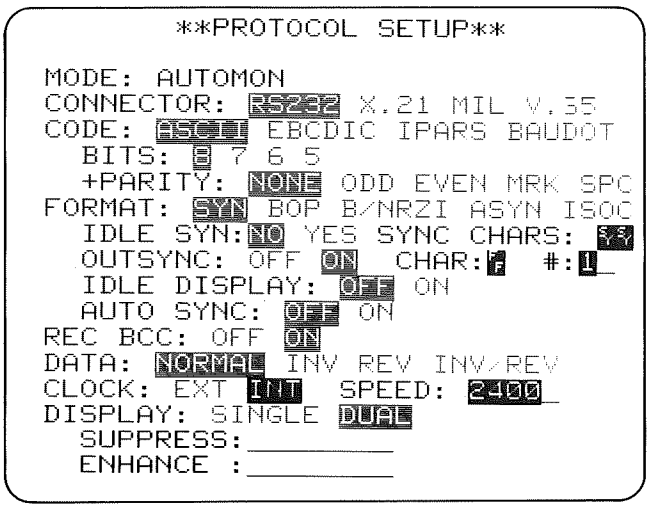


Figure H-1 Select ASCII in the CODE field.

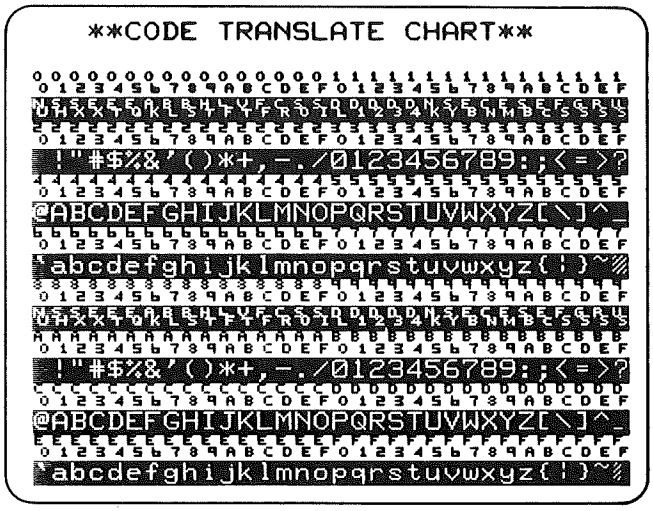


Figure H-2 ASCII Code Translate Chart.

APPENDIX H
ADJUSTMENTS, MAINTENANCE, AND SERVICE INFORMATION

H.1 GENERAL CLEANING

Exterior surfaces may be wiped clean with a soft damp cloth. To remove accumulations of dirt or fingerprints from the case or the keyboard use a cloth dampened with a mild detergent. Do not use abrasive or solvent-type cleaners, which may damage the plastic surfaces.

H.2 CRT BRIGHTNESS ADJUSTMENT

The CRT brightness adjustment has been preset at the factory for the optimal display brightness. If it becomes necessary to adjust the brightness, follow this procedure. (You will need a small screwdriver.)

(1) Allow the CRT to warm up for at least 5 minutes.

(2) Select ASCII in the CODE field on the Protocol Setup menu (Figure H-1). Press the PROGRAM key followed by E to display the Code Translate Chart (Figure H-2).

(3) The brightness control is located on the rear panel next to the VIDEO OUT connector.

(4) Observing the display, turn the adjusting screw counterclockwise to increase the brightness until defocusing occurs. This will be most noticeable around the bright characters, as on the first line. The bright characters will appear to bleed into the dark background.

(5) Now back the brightness adjustment down (clockwise) just to the point that defocusing or bleeding is eliminated.

This is the maximal usable brightness setting. A higher setting will degrade the clarity of the display. If a lower setting is desired for a low ambient light environment, be careful not to reduce the brightness to the point that low-intensity characters are illegible. Check the contrast on the Protocol Setup menu.

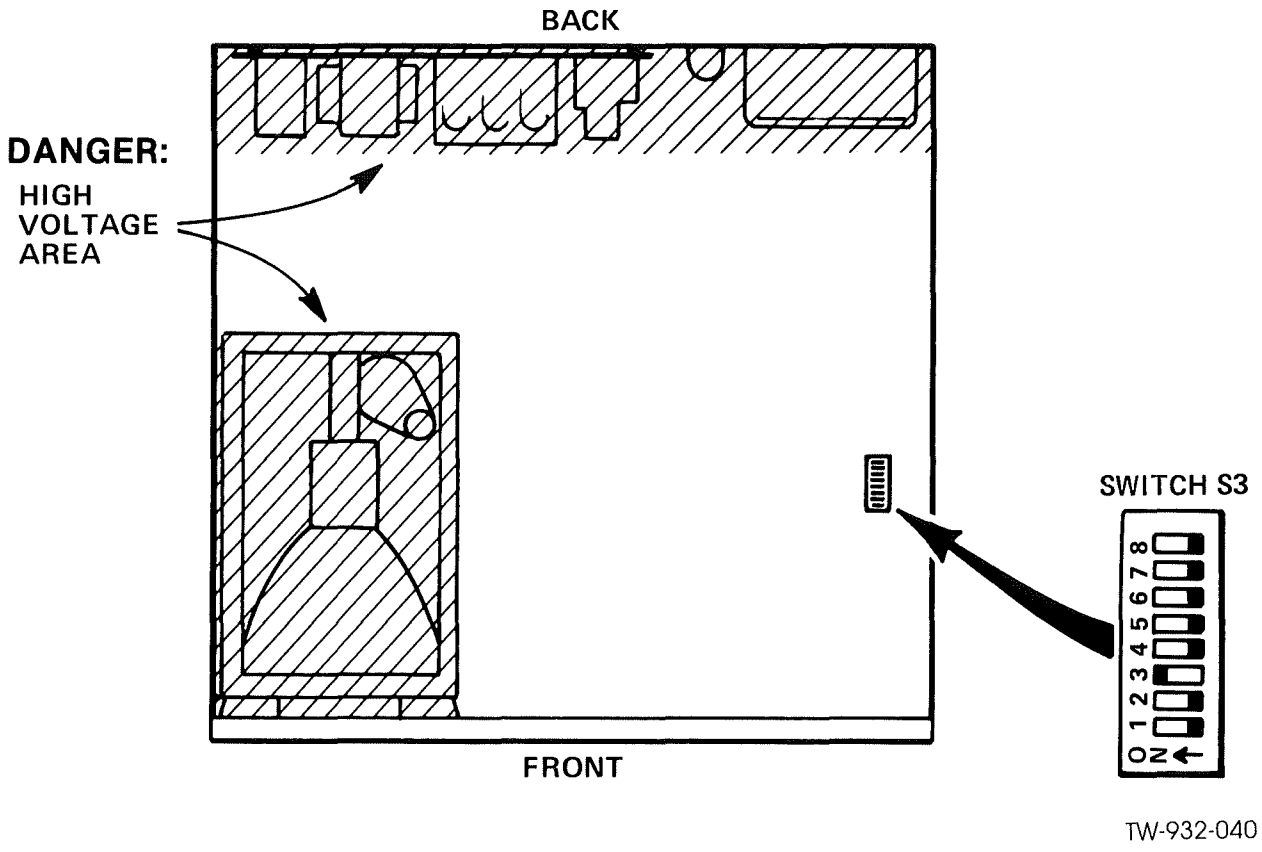


Figure H-3 Diagram of COMSTATE I with top cover removed.

H.3 REMOVING THE TOP COVER

WARNING: Removing the top cover of the COMSTATE I with or without the power cord connected may expose personnel to dangerous high voltages and high-vacuum CRT hazard. Under no circumstances should anyone but qualified service technicians remove the top cover of this instrument.

You will need a Phillips (crosspoint) screwdriver to remove the top cover.

(1) Disconnect the power cord from the COMSTATE I and remove the keyboard. Rotate the stand back against the bottom of the case so the unit will lie flat on the the work surface.

(2) Twelve screws must be removed: three screws on each side, about 1 1/2 inches from the bottom of the unit; two screws on the top near the front edge of the cover; two on the rear just below the top edge; and one on the rear under each foot.

(3) Lift the cover up and then off, keeping your fingers on the outside of the case.

WARNING: Figure H-3 shows the location of the hazardous areas inside the case. Please refer to this drawing before you proceed any further.

(4) To replace the cover, reverse this procedure. Notice that the two longest screws go under the two feet on the rear and the two shortest screws are for the top front of the cover.

H.4 POWER FREQUENCY SELECTION

WARNING: Do not attempt this adjustment until you have read Section H.3.

Switch S3-1 (shown in Figure H-3) controls the power frequency selection between 50- and 60-cycle operation. You can reach Switch S3 via the easy access cover on the top of the COMSTATE I (if you have installed memory cards, you may remove them for easier access to Switch S3). Switch S3 must be set as follows:

S3-1, OFF for 60-Hz power frequency; ON for 50 Hz.
S3-2, OFF
S3-3, ON
S3-4, OFF
S3-5, OFF
S3-6, OFF
S3-7, OFF
S3-8, OFF

H.5 DETERMINING CRT TYPE

There are two types of CRT assemblies used in the COMSTATE I, one supplied by Motorola and the other by Ball Bros. Check which type of CRT is in the COMSTATE I. The Motorola CRT (see Figure H-4a) is in a silver-colored sheet metal frame. Its PC board is on the bottom of the assembly, and the wiring is connected by an edge connector on the rear of its PC board. The Ball Bros. CRT (see Figure H-4b) is assembled in a yellow-colored wire metal frame. Its PC board and the wiring connector are on the side of the assembly.

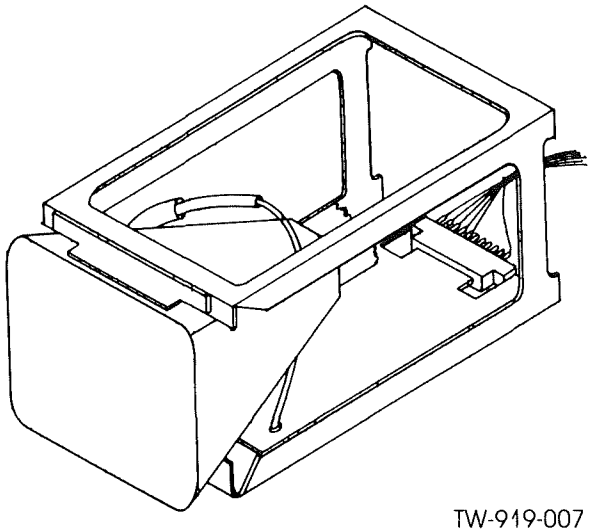


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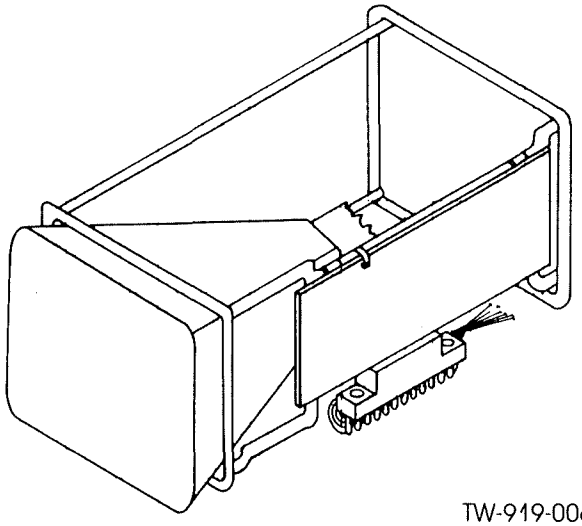
Figure H-4a Motorola CRT Assembly.



TW-919-006

Figure H-4b Ball Bros. CRT Assembly.

H.6 MOTOROLA CRT ADJUSTMENTS

The CRT adjustments given in this section are presented as separate procedures. However, usually, they would be performed as a series in one session. In that case, it would not be necessary, for example, to turn on the unit or re-display the Code Translate Chart at the beginning of each procedure.

WARNING: CRT adjustments are hazardous. They should be done only by personnel with previous training and experience working with CRTs.

NOTE: Always turn on the unit and allow the CRT to warm up for at least 5 minutes before doing any CRT adjustments.

H.6.1 Vertical Hold

The CRT assembly is delivered with the vertical hold preset. Changing the frequency setting of the COMSTATE I between 50 and 60 Hz may cause the display to roll. To correct this, adjust R206, VERT HOLD, near the edge connector at the rear of the CRT PC board (see Figure H-5). (Note: If the frequency has been correctly adjusted at 50 Hz, no vertical hold adjustment should be required when the frequency is changed to 60 Hz.)

H.6.2 Raster Centering

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Adjust the BRIGHTNESS control next to the VIDEO OUT jack on the rear panel of the COMSTATE I counterclockwise for minimum contrast. No data should be visible on the screen.

(2) Potentiometer R108 is on the CRT PC board (Figure H-5) just inboard of the edge connector at the rear. Adjust R108 until you see the CRT raster pattern.

(3) If necessary, adjust the VERT SIZE control, R208, so that all edges of the raster are visible.

(4) Rotate the two ring magnets on the yoke to center the raster on the screen.

H.6.3 Brightness

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by the E key) on the CRT.

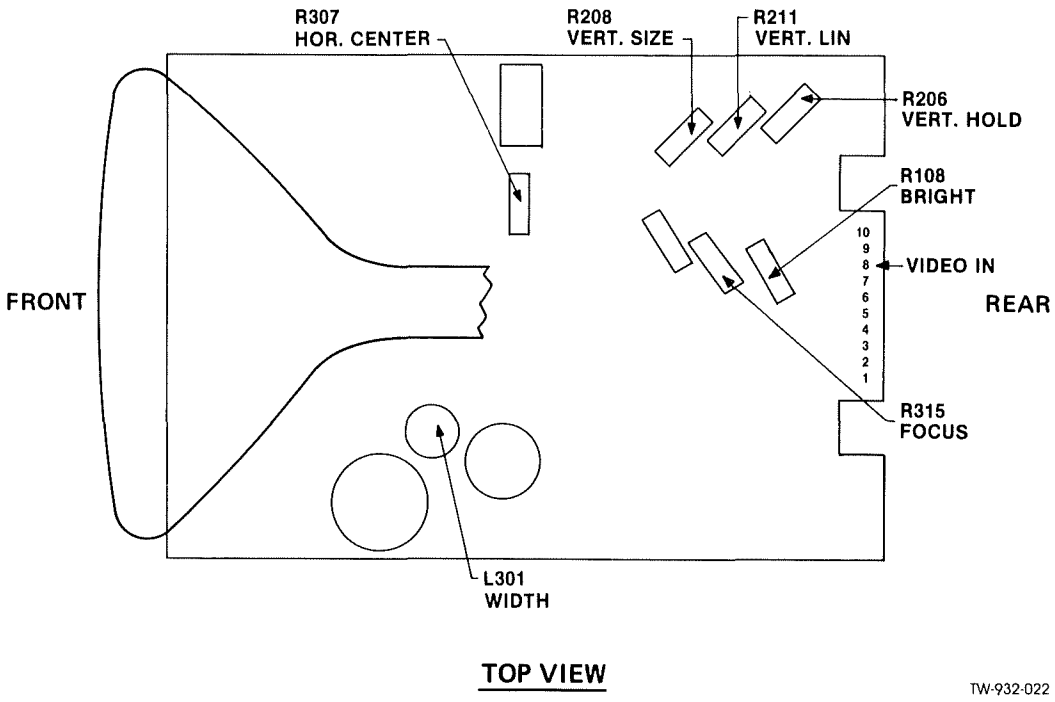


Figure H-5 Motorola CRT PC Board.

(2) Adjust the BRIGHTNESS adjuster screw next to the VIDEO OUT jack on the rear panel of the COMSTATE I counterclockwise for minimum contrast. No data should be visible on the screen.

(3) Potentiometer R108 is on the CRT PC board (Figure H-5) just inboard of the edge connector at the rear. Rotate R108 until you see the CRT raster pattern.

(4) Turn R108 down (counterclockwise) until the raster just disappears; then turn R108 back and forth slightly until you are sure you have found the point at which the raster disappears.

(5) Adjust the BRIGHTNESS adjuster screw on the rear panel for optimum contrast. Be sure all reverse-image areas are clearly defined. Check that all fields on the Protocol Setup menu are clearly distinguishable.

H.6.4 Vertical Size

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by the E key) on the CRT.

(2) The VERT SIZE control, R208, is located near the outer edge of the CRT board about 2 inches inboard of the rear edge (see Figure H-5). Rotate R208 to adjust the display to its optimum size.

H.6.5 Horizontal Size

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key) on the CRT.

(2) Coil L301 is on the CRT PC board just to the inside of the CRT (see Figure H-5). Use a nonconductive CRT hex alignment tool to adjust coil L301 until the display is the desired width.

H.6.6 Horizontal Centering

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by the E key) on the CRT.

(2) Adjust R307, HORizontal CENTER, located on the CRT PC board just outside the CRT.

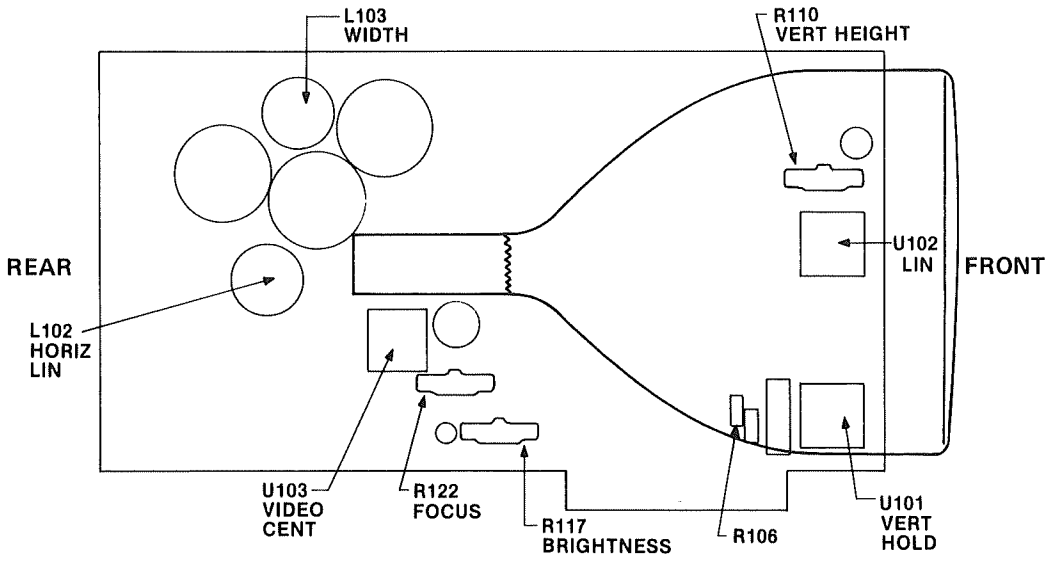


Figure H-6 Ball Bros. CRT PC Board.

H.6.7 Focus

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key) on the CRT.

(2) The FOCUS control, R315, is on the CRT PC board just forward of the BRIGHTNESS control. Adjust R315 so that a character at the center of the row approximately one third of the way down from the top of the screen is in best focus.

H.6.8 Vertical Linearity

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key) on the CRT.

(2) The VERT. LINEARITY control, R211, is located just to the rear of the VERT SIZE control. Adjust R211 until the characters in the top and bottom rows of the display are the same height as characters in the center row. This adjustment may disturb the vertical hold adjustment.

H.7 BALL BROS. CRT

WARNING: CRT adjustments are hazardous. They should be done only by personnel with previous training and experience working with CRTs.

NOTE: Always turn on the unit and allow the CRT to warm up for at least 5 minutes before doing any CRT adjustments.

H.7.1 Vertical Hold

The CRT assembly is delivered with the vertical hold preset. Changing the frequency setting of the COMSTATE I between 50 and 60 Hz may cause the display to roll. To correct this, adjust U101, VERT HOLD, which is in front of the edge connector on the CRT PC board (see Figure H-6). (Note: If the frequency has been correctly adjusted at 50 Hz, no vertical hold adjustment should be required when the frequency is changed to 60 Hz.)

H.7.2 Raster Centering

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Adjust the BRIGHTNESS control next to the VIDEO OUT jack on the rear panel of the COMSTATE I counterclockwise for minimum contrast. No data should be visible on the screen.

(2) Potentiometer R117, BRIGHTNESS is on the CRT PC board (Figure H-6) just behind the edge connector. Rotate R117 until you see the CRT raster pattern.

(3) If necessary, adjust the VERT HEIGHT control, R110, so that all edges of the raster are visible.

(4) Adjust the two ring magnets on the yoke to center the raster on the screen.

H.7.3 Brightness

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by the E key) on the CRT.

(2) Adjust the BRIGHTNESS control next to the VIDEO OUT jack on the rear panel of the COMSTATE I counterclockwise for minimum contrast. No data should be visible on the screen.

(3) Potentiometer R117 is on the CRT PC board (Figure H-6) just behind the edge connector. Rotate R117 until you see the CRT raster pattern.

(4) Turn R117 down until the raster just disappears; then turn R117 back and forth slightly until you are sure you have found the point at which the raster disappears.

(5) Adjust the BRIGHTNESS control on the rear panel for optimum contrast. Be sure all reverse-image areas are clear. Check that all fields on the Protocol Setup menu are clearly distinguishable.

H.7.4 Vertical Size

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by the E key) on the CRT.

(2) The VERT HEIGHT control, R110, is at the front of the CRT PC board (see Figure H-6). Rotate R110 to adjust the display to its optimum height.

H.7.5 Horizontal Size

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key).

(2) Coil L103 (see Figure H-6) can be adjusted from the solder side of the CRT PC board. Use a nonconductive CRT hex alignment tool to adjust L103 for the desired width.

H.7.6 Horizontal Centering

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key) on the CRT.

(2) Adjust the VIDEO CENTering control, U103 on the CRT PC Board, to center the display horizontally.

H.7.7 Focus

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key) on the CRT.

(2) The FOCUS control, R122, is on the CRT PC board above the BRIGHTNESS control. Adjust R122 so that a character at the center of the row approximately one third of the way down from the top of the screen is in best focus.

H.7.8 Horizontal Linearity

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key) on the CRT.

(2) Coil L102, HORIZontal LINearity, can be adjusted from the solder side of the CRT PC board (see Figure H-6). Use a nonconductive CRT alignment tool to adjust L102 so that characters in the left- and rightmost columns of the display are the same width as characters in the center column. To prevent excessive power consumption, do not adjust the L102 core out any further than necessary.

H.7.9 Vertical Linearity

NOTE: Turn on the COMSTATE I and allow the CRT to warm up for 5 minutes.

(1) Display a Code Translate Chart (PROG key followed by E key).

(2) Adjust the vertical LINearity control, U102 on the CRT PC Board, until the characters in the top and bottom rows of the display are the same height as characters in the center row. Since this control affects the vertical frequency slightly, the Vertical Hold may then have to be readjusted.

H.8 FUSE

A 3-ampere fuse is installed in the voltage selector-power connector module on the rear of the COMSTATE I. To inspect or replace the fuse, remove the power cord and slide the transparent window to the left. Swing the fuse extractor handle out toward the left and remove the fuse. Rotate the extractor handle in and replace the fuse.

H.9 POWER-UP SELF TESTS:

If any of the following Self Test Error Codes appear on the power-up menu, the COMSTATE I will not operate properly. Make a record of the error code and contact Atlantic Research Corporation for service information.

We will need to know the model number and software version of the unit in addition to the error code information.

The following is a list of Self Test Error Codes that may appear (in units with software levels 2.02B and above):

0(ww,xxxx,yy,zz)	RAM
1	PROM AA
2	PROM AB
3	PROM AC
4	PROM AD
5	PROM AE
6	PROM AF
77	PROM AG
8	PROM AH
9	PROM AJ
A	PROM AK
BB	PROM AL
CC	PROM AM

H.9.1 Error Codes

If a Self-Test Error Code appears on the power-up menu, the COMSTATE I will not operate properly.

Turn off the unit. Check that DIP switch S3 is correctly set. Then power up the unit and recheck the Self Test display.

The error codes can be used to locate the component (chip) that is malfunctioning. To interpret the information appended to Error Code 0, see Section H.9.2.

H.9.2 RAM Errors

When a RAM error is found during the power-up self tests, self-test error code 0 is displayed followed by a 10-digit hexadecimal code that enables you to find the RAM chip in which the error has occurred. This code is in the form

0 (ww, xxxx, yy, zz)

The first two digits (ww) identify the location within the RAM where the error occurred. The second four digits (xxxx) are the hexadecimal RAM address of the error. This will be of use if you are using a logic analyzer. The next two digits (yy) represent the data written to the errored location; while the last two (zz) represent the data read from that location.

The RAM error code can be interpreted as follows. There are 16 RAM chips on the main PC board, at locations UI9 through UI16 and UJ9 through UJ16. (See Figure H-7.) If the address (xxxx in the power-up code) is in the hexadecimal range C000 through FFFF, the error has occurred in a chip in the UI row; if the address is in the range 8000 through BFFF the error has occurred in a chip in the UJ row.

To find the specific chip where the error occurred, look at the read (yy) and write (zz) values in the error code. Notice whether the discrepancy between the read and write values is in the high-order or the low-order digit; then, on Figure H-8, refer to only the high- or the low-order section of the applicable row.

In Figure H-8, a binary value is assigned to each RAM chip. Find the difference between the read and write values of the errored hex digit and compare it with the binary values in the correct row and section in Figure H-8. The errored chip will have the binary value equal to the difference between the read and the write values in the displayed error code.

For example, if the displayed error code is 0 (00, 8000, 00, 04), the error will be in the UJ row of RAM chips, since the first digit in the address is 8, and in one of RAM chips UJ9 through UJ16, since the discrepancy between write and read values is in the low-order digit. Since the difference between the low-order write and read digit is 4 (= 0100), the faulty chip is at location UJ14.

Another example: If the displayed error code is 0 (01, C000, 00, 90), the error will be in the high-order section of the UI row. Actually, there will be two faulty chips, UI16 and UI9, because adding binary 1000 and 0001 is the only way to get a binary 1001 (= 9, hex) from the four possible binary numbers in the high-order section of the row.

NOTE: Having three or more ICs in error is highly unlikely. If the situation occurs, contact Atlantic Research Corporation for further instruction.

H.10 ERROR CODES IN RUN MODE

There are a number of error messages that indicate only that you have programmed a unit to do something it doesn't know how to do. Atlantic Research Corporation would appreciate it if you would let us know how all the program menus were set up when you received any of the following messages:

CMP ERR (01)
CMP ERR (02)
OVRFLW (10)
OVRFLW (11)
OVRFLW (12)

If you should receive the following error message,

XMIT OVERFLOW (20)

please record how the Interactive Test menu (Program 7) was set up and contact Atlantic Research Corporation.

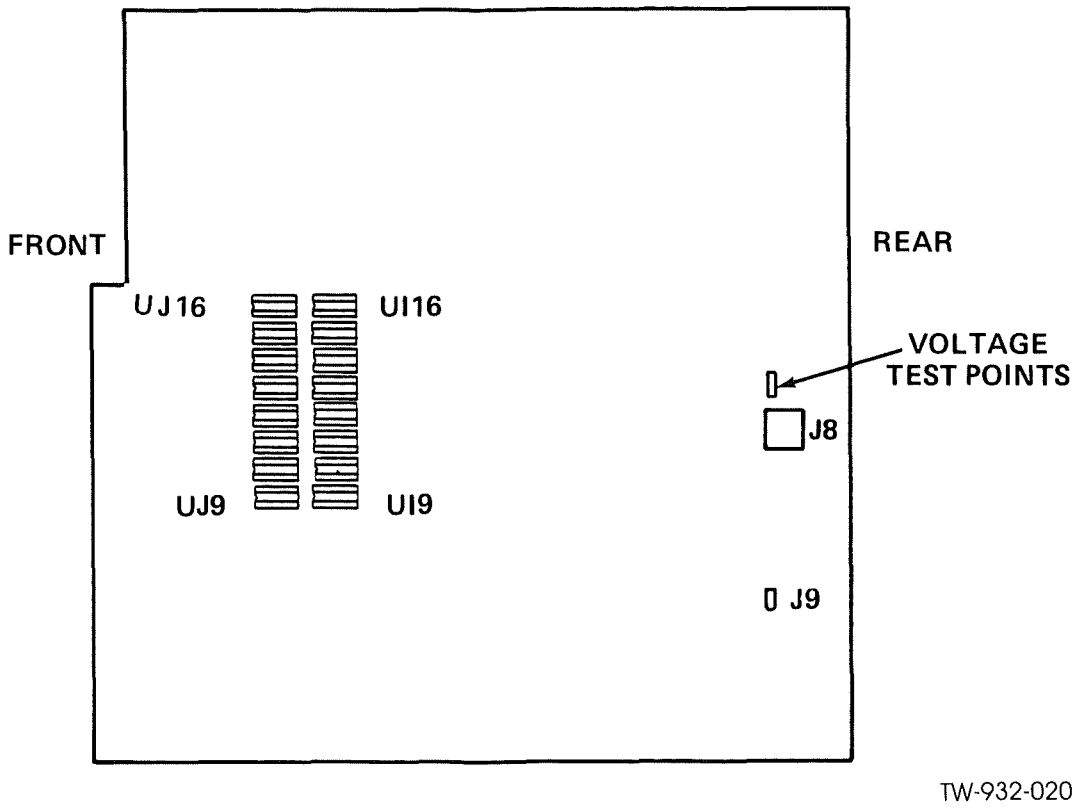


Figure H-7 RAM location on Main PC Board.

	LOW-ORDER HEX DIGIT				HIGH-ORDER HEX DIGIT			
C000	UI16	UI15	UI14	UI13	UI12	UI11	UI10	UI9
FFFF	0001	0010	0100	1000	0001	0010	0100	1000

8000	UJ16	UJ15	UJ14	UJ13	UJ12	UJ11	UJ10	UJ9
BFFF	0001	0010	0100	1000	0001	0010	0100	1000

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Figure H-8 Interpreting RAM error codes.

APPENDIX I
SELECTABLE DATA SPEEDS

The numbers listed in this appendix represent the data speeds (of 47.96 bps and higher) that can be selected precisely on the COMSTATE I menus. Speeds are in bits per second. If other speeds are entered, they will be approximated only.

28800.00	929.03	472.13	316.48	238.02	190.73	159.12	136.49	119.50	106.27
19200.00	914.29	468.29	314.75	237.04	190.10	158.68	136.17	119.25	106.08
14400.00	900.00	464.52	313.04	236.07	189.47	158.24	135.85	119.01	105.88
11520.00	886.15	460.80	311.35	235.10	188.85	157.81	135.53	118.76	105.69
9600.00	872.73	457.14	309.68	234.15	188.24	157.38	135.21	118.52	105.49
8228.57	859.70	453.54	308.02	233.20	187.62	156.95	134.89	118.28	105.30
7200.00	847.06	450.00	306.38	232.26	187.01	156.52	134.58	118.03	105.11
6400.00	834.78	446.51	304.76	231.33	186.41	156.10	134.27	117.79	104.92
5760.00	822.86	443.08	303.16	230.40	185.81	155.68	133.95	117.55	104.73
5236.36	811.27	439.69	301.57	229.48	185.21	155.26	133.64	117.31	104.54
4800.00	800.00	436.36	300.00	228.57	184.62	154.84	133.33	117.07	104.35
4430.77	789.04	433.08	298.45	227.67	184.03	154.42	133.03	116.84	104.16
4114.29	778.38	429.85	296.91	226.77	183.44	154.01	132.72	116.60	103.97
3840.00	768.00	426.67	295.38	225.88	182.86	153.60	132.41	116.36	103.78
3600.00	757.89	423.53	293.88	225.00	182.28	153.19	132.11	116.13	103.60
3388.24	748.05	420.44	292.39	224.12	181.70	152.79	131.81	115.90	103.41
3200.00	738.46	417.39	290.91	223.26	181.13	152.38	131.51	115.66	103.23
3031.58	729.11	414.39	289.45	222.39	180.56	151.98	131.21	115.43	103.04
2880.00	720.00	411.43	288.00	221.54	180.00	151.58	130.91	115.20	102.86
2742.86	711.11	408.51	286.57	220.69	179.44	151.18	130.61	114.97	102.67
2618.18	702.44	405.63	285.15	219.85	178.88	150.79	130.32	114.74	102.49
2504.35	693.98	402.80	283.74	219.01	178.33	150.39	130.02	114.51	102.31
2400.00	685.71	400.00	282.35	218.18	177.78	150.00	129.73	114.29	102.13
2304.00	677.65	397.24	280.98	217.36	177.23	149.61	129.44	114.06	101.95
2215.38	669.77	394.52	279.61	216.54	176.69	149.22	129.15	113.83	101.77
2133.33	662.07	391.84	278.26	215.73	176.15	148.84	128.86	113.61	101.59
2057.14	654.55	389.19	276.92	214.93	175.61	148.45	128.57	113.39	101.41
1986.21	647.19	386.58	275.60	214.13	175.08	148.07	128.29	113.16	101.23
1920.00	640.00	384.00	274.29	213.33	174.55	147.69	128.00	112.94	101.05
1858.06	632.97	381.46	272.99	212.55	174.02	147.31	127.72	112.72	100.88
1800.00	626.09	378.95	271.70	211.76	173.49	146.94	127.43	112.50	100.70
1745.45	619.35	376.47	270.42	210.99	172.97	146.56	127.15	112.28	100.52
1694.12	612.77	374.03	269.16	210.22	172.46	146.19	126.87	112.06	100.35
1645.71	606.32	371.61	267.91	209.45	171.94	145.82	126.59	111.84	100.17
1600.00	600.00	369.23	266.67	208.70	171.43	145.45	126.32	111.63	100.00
1556.76	593.81	366.88	265.44	207.94	170.92	145.09	126.04	111.41	99.83
1515.79	587.76	364.56	264.22	207.19	170.41	144.72	125.76	111.20	99.65
1476.92	581.82	362.26	263.01	206.45	169.91	144.36	125.49	110.98	99.48
1440.00	576.00	360.00	261.82	205.71	169.41	144.00	125.22	110.77	99.31
1404.88	570.30	357.76	260.63	204.98	168.91	143.64	124.95	110.56	99.14
1371.43	564.71	355.56	259.46	204.26	168.42	143.28	124.68	110.34	98.97
1339.53	559.22	353.37	258.30	203.53	167.93	142.93	124.41	110.13	98.80
1309.09	553.85	351.22	257.14	202.82	167.44	142.57	124.14	109.92	98.63
1280.00	548.57	349.09	256.00	202.11	166.96	142.22	123.87	109.71	98.46
1252.17	543.40	346.99	254.87	201.40	166.47	141.87	123.61	109.51	98.29
1225.53	538.32	344.91	253.74	200.70	165.99	141.52	123.34	109.30	98.13
1200.00	533.33	342.86	252.63	200.00	165.52	141.18	123.08	109.09	97.96
1175.51	528.44	340.83	251.53	199.31	165.04	140.83	122.81	108.88	97.79
1152.00	523.64	338.82	250.43	198.62	164.57	140.49	122.55	108.68	97.63
1129.41	518.92	336.84	249.35	197.94	164.10	140.15	122.29	108.47	97.46
1107.69	514.29	334.88	248.28	197.26	163.64	139.81	122.03	108.27	97.30
1086.79	509.73	332.95	247.21	196.59	163.17	139.47	121.78	108.07	97.13
1066.67	505.26	331.03	246.15	195.92	162.71	139.13	121.52	107.87	96.97
1047.27	500.87	329.14	245.11	195.25	162.25	138.80	121.26	107.66	96.81
1028.57	496.55	327.27	244.07	194.59	161.80	138.46	121.01	107.46	96.64
1010.53	492.31	325.42	243.04	193.94	161.34	138.13	120.75	107.26	96.48
993.10	488.14	323.60	242.02	193.29	160.89	137.80	120.50	107.06	96.32
976.27	484.03	321.79	241.00	192.64	160.45	137.47	120.25	106.86	96.16
960.00	480.00	320.00	240.00	192.00	160.00	137.14	120.00	106.67	96.00
944.26	476.03	318.23	239.00	191.36	159.56	136.82	119.75	106.47	95.84

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95.68	87.01	79.78	73.66	68.41	63.86	59.88	56.36	53.23	50.44
95.52	86.88	79.67	73.56	68.33	63.79	59.81	56.30	53.19	50.39
95.36	86.75	79.56	73.47	68.25	63.72	59.75	56.25	53.14	50.35
95.21	86.62	79.45	73.38	68.17	63.65	59.69	56.20	53.09	50.31
95.05	86.49	79.34	73.28	68.09	63.58	59.63	56.14	53.04	50.26
94.89	86.36	79.23	73.19	68.00	63.51	59.57	56.09	52.99	50.22
94.74	86.23	79.12	73.10	67.92	63.44	59.50	56.03	52.94	50.17
94.58	86.10	79.01	73.00	67.84	63.37	59.44	55.98	52.89	50.13
94.43	85.97	78.90	72.91	67.76	63.30	59.38	55.92	52.84	50.09
94.27	85.84	78.80	72.82	67.69	63.23	59.32	55.87	52.80	50.04
94.12	85.71	78.69	72.73	67.61	63.16	59.26	55.81	52.75	50.00
93.96	85.59	78.58	72.64	67.53	63.09	59.20	55.76	52.70	49.96
93.81	85.46	78.47	72.54	67.45	63.02	59.14	55.71	52.65	49.91
93.66	85.33	78.37	72.45	67.37	62.95	59.08	55.65	52.60	49.87
93.51	85.21	78.26	72.36	67.29	62.88	59.02	55.60	52.55	49.83
93.35	85.08	78.15	72.27	67.21	62.81	58.96	55.54	52.51	49.78
93.20	84.96	78.05	72.18	67.13	62.75	58.90	55.49	52.46	49.74
93.05	84.83	77.94	72.09	67.05	62.68	58.84	55.44	52.41	49.70
92.90	84.71	77.84	72.00	66.98	62.61	58.78	55.38	52.36	49.66
92.75	84.58	77.73	71.91	66.90	62.54	58.72	55.33	52.32	49.61
92.60	84.46	77.63	71.82	66.82	62.47	58.66	55.28	52.27	49.57
92.46	84.33	77.52	71.73	66.74	62.41	58.60	55.23	52.22	49.53
92.31	84.21	77.42	71.64	66.67	62.34	58.54	55.17	52.17	49.48
92.16	84.09	77.32	71.55	66.59	62.27	58.48	55.12	52.13	49.44
92.01	83.97	77.21	71.46	66.51	62.20	58.42	55.07	52.08	49.40
91.87	83.84	77.11	71.38	66.44	62.14	58.36	55.01	52.03	49.36
91.72	83.72	77.01	71.29	66.36	62.07	58.30	54.96	51.99	49.32
91.57	83.60	76.90	71.20	66.28	62.00	58.24	54.91	51.94	49.27
91.43	83.48	76.80	71.11	66.21	61.94	58.18	54.86	51.89	49.23
91.28	83.36	76.70	71.02	66.13	61.87	58.12	54.80	51.85	49.19
91.14	83.24	76.60	70.94	66.06	61.80	58.06	54.75	51.80	49.15
91.00	83.12	76.49	70.85	65.98	61.74	58.01	54.70	51.75	49.10
90.85	83.00	76.39	70.76	65.90	61.67	57.95	54.65	51.71	49.06
90.71	82.88	76.29	70.67	65.83	61.60	57.89	54.60	51.66	49.02
90.57	82.76	76.19	70.59	65.75	61.54	57.83	54.55	51.61	48.98
90.42	82.64	76.09	70.50	65.68	61.47	57.77	54.49	51.57	48.94
90.28	82.52	75.99	70.42	65.60	61.41	57.72	54.44	51.52	48.90
90.14	82.40	75.89	70.33	65.53	61.34	57.66	54.39	51.47	48.85
90.00	82.29	75.79	70.24	65.45	61.28	57.60	54.34	51.43	48.81
89.86	82.17	75.69	70.16	65.38	61.21	57.54	54.29	51.38	48.77
89.72	82.05	75.59	70.07	65.31	61.15	57.49	54.24	51.34	48.73
89.58	81.93	75.49	69.99	65.23	61.08	57.43	54.19	51.29	48.69
89.44	81.82	75.39	69.90	65.16	61.02	57.37	54.14	51.25	48.65
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87.41	80.11	73.94	68.65	64.07	60.06	56.53	53.38	50.57	48.04
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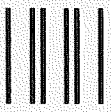

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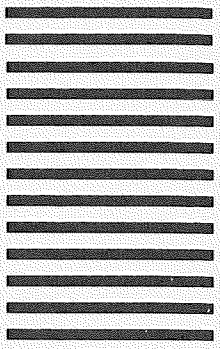

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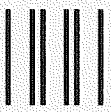

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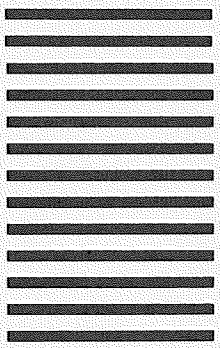

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